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CUTRIGHT (C. R.). **The Season's Experiments with Red Mite Control.**—*Proc. Ohio hort. Soc.* **75** pp. 32-44. [Columbus, Ohio, 1942.]

Infestation by the European red mite [*Paratetranychus pilosus*, C. & F.] was severe in Ohio in 1918-22 and 1926-29 and from 1936 onwards. Observations showed that the mites are carried from unsprayed to sprayed trees by wind, but the heaviest infestations observed occurred in orchards in which the application of a dormant oil spray had been discontinued for one year. In two orchards in which oil sprays had never been used, injury occurred about once in 3-5 years, but was generally less severe. The mite is often more abundant in well-cultivated orchards than in neglected ones, since growth is more vigorous in the former and the leaves provide better food, and oil sprays in the dormant season and sulphur sprays in summer are also toxic to predacious mites [*cf. R.A.E., A* **30** 536]. When poor and vigorous trees in the same orchard bear equal populations, injury appears first on the former, but the mites may migrate from them before depositing winter eggs owing to exhaustion of the food-supply; on vigorous trees, the foliage provides food until the time at which winter eggs are laid.

Since damage was severe in 1940, investigations were carried out in 1941 to determine whether oil sprays were becoming less effective against the mite and whether the concentration of oil should be increased. As in previous years, populations on trees sprayed with lime-sulphur, Loro [aliphatic thiocyanates (*cf.* **28** 615)] or tar oil were high early in the season and reached a peak by 1st August, whereas on those sprayed with petroleum oil they were low from May to early July and increased rapidly in August, reaching a peak in September. In the laboratory, both tank-mixed and soluble oils were more effective against the eggs of the mite at 4 than at 3 per cent., but in the orchard the difference in injury later in the season was not marked, and where the lower concentration has proved satisfactory its use should be continued. A tank-mixed oil spray at 3 and 4 per cent. resulted in 3.3 and 0.3 per cent. hatch when the emulsifier was Bordeaux mixture and 7.4 and 3 per cent. when it was sulphite lye (Goulac). Only 0.8 per cent. of the eggs on twigs sprayed with 3 per cent. tank-mixed oil emulsified with Bordeaux mixture hatched when the application was made late, as compared with 1.1 per cent. after an early application. The recommended time of application is just before the leaves appear.

Estimates of the rate of increase of the mite show that it will not become abundant on trees that have been sprayed with oil until it has completed four generations; it is therefore desirable to develop a spray that could be used against the fourth generation and also against other pests. Excellent control of *P. pilosus* was obtained by including summer oil in sprays applied 3-6 times against the codling moth [*Cydia pomonella*, L.] on apple, but a rotenone spray is advised if a single application is required for emergency control of the mite [*cf.* **30** 536]. In tests on experimental plots, sprays containing 0.5 per cent. oil and 1½ or 3 lb. ground derris root (4 per cent. rotenone) per 100 U.S. gals. or a proprietary rotenone preparation at 2 lb. per 100 U.S. gals., applied during the last week in August, were all effective, as were others comprising 0.33 per cent. oil with 2 or 4 lb. of the proprietary preparation per 100 U.S. gals. The proprietary preparation was also used by growers in two orchards in which the infestation developed very early and injury was evident by 1st July. When it was applied on 10th July at the rate of 4 lb. per 100 U.S. gals. with an adhesive (Orthex), the foliage regained and retained much of its green colour, but no benefit resulted from treatment of other trees on 25th July as the leaves had been irreparably damaged and the mites were already decreasing in numbers. The recommended rotenone spray contains 2½ lb. ground derris root (5 per cent. rotenone) per 100 U.S. gals. with 0.5 per cent. oil or an adhesive.

PRATT (R. Y.). **Insect Enemies of the Scarabaeid *Polyphylla crinita* Lec. (Coleoptera : Scarabaeidae).**—*Pan-Pacif. Ent.* **19** no. 2 pp. 69–70, 4 refs. San Francisco, Calif., 1943.

Larvae of the Melolonthid, *Polyphylla crinita*, Lec., occur in large numbers in well-drained sandy soil on Whidbey Island, Washington, where they cause local damage to strawberry and Dutch iris. The adults emerge during July and the beginning of August. Instances are given of the adults being killed by the Asilid, *Stenopogon inquinatus*, Lw., in the field, and of a larva being destroyed by adults of *Carabus taedatus*, F., with which it was confined in a small glass jar. Neither of these predators is common enough on the Island to control the beetle.

COMPÈRE (H.). **A new Species of *Metaphycus* parasitic on Psyllids.**—*Pan-Pacif. Ent.* **19** no. 2 pp. 71–73. San Francisco, Calif., 1943.

Descriptions are given of the adults of both sexes of the Encyrtid, *Metaphycus psyllidis*, sp. n., which was bred from nymphs of *Paratrioza cockerelli*, Sulc, on chili pepper (*Capsicum* sp.) in California. All the other species of this genus have been reared from Coccids.

MICHELbacher (A. E.). ***Petunia*, an important Winter Host of the Tomato Mite.**—*Pan-Pacif. Ent.* **19** no. 2 p. 73. San Francisco, Calif., 1943.

Phyllocoptes destructor, Keifer, has been observed overwintering in large numbers on *Petunia*, and infestation of this plant in a district in California was so heavy on 29th April 1943 that the bases of the stems and the lower leaves were bronzed as a result of the feeding. *Petunia* may therefore constitute a source of infestation for tomato.

VAN ZWALUWENBURG (R. H.). **A recent immigrant Tachinid Fly Parasite of Noctuid Caterpillars in Hawaii.**—*Hawaii. Plant. Rec.* **47** no. 2 pp. 81–87, 4 figs., 12 refs. Honolulu, 1943.

A Tachinid found in considerable numbers in a potato field adjacent to sugarcane on Oahu in April 1942 was identified as *Blondelia* (*Eucelatoria*) *armigera*, Coq., which occurs in the southern United States, eastern Mexico, Cuba and Porto Rico. It is the small Tachinid that Osborn reared from *Cirphis latiuscula*, H.-S., in Vera Cruz, Mexico and sent to Hawaii in 1933 [cf. *R.A.E.*, A **26** 586], when it failed to survive the journey, and a fly bred in 1941 from a caterpillar found in a tomato purchased in Honolulu and imported probably from Mexico was found to belong to the same species. It is therefore presumed to have become established through the importation of tomatoes from America. Small colonies have been sent to central Maui.

The parasite attacks destructive larvae of several species, including those of *Heliothis armigera*, Hb., and was reared in the laboratory on this Noctuid and *Laphygma eximpta*, Wlk. It was bred from larvae of *Plusia chalcites*, Esp., on orchids of the genus *Spathoglottis* at Honolulu in 1942, and was later found to parasitise this species commonly. The female deposits nearly mature larvae in the body of the host. Parasitised *Laphygma* larvae suffer complete collapse, sometimes within a day of being attacked, but those of *Heliothis* and *Plusia* continue to be active and apparently normal for as much as five days. Larvae of *Pieris rapae*, L., were not attacked. When fully fed, the parasite larvae leave the host and pupate in the soil. During winter, the life-cycle lasts 18–19 days; adults mated within 8 hours of emergence, females deposited larvae 6 days later and the period from larviposition to adult emergence lasted 12–13 days.

during January and February, the average feeding period in the host being just over 4 days. Males and females were bred in approximately equal numbers, and, when fed on brown sugar and water, lived for up to 17–18 days (with the exception of one sterile female, which lived for 30 days). The largest number of offspring per female was 42 puparia, but the potential productivity is much higher. Several of the apparently sterile females pierced *Laphygma* larvae so severely that they soon showed the collapse typical of parasitised individuals. The feeding time in the host was little affected by external temperature and was somewhat longer for males than females, but the pupal stage was prolonged by lower temperatures and was slightly longer in the case of females. The greatest number of parasites that developed from one host under field conditions was nine, from a *Plusia* larva; 1–8 puparia were obtained from *Laphygma*. The length of time spent by the parasite larvae in a host was inversely proportional to the number in the host.

D'ANGELO (W. A.). **La chinche del arroz más conocida por "percevejo." Un insecto dañino para el cultivo del arroz en la costa del Uruguay.** [The Rice Bug. An Insect injurious to Rice on the Bank of the Uruguay.]—*Alm. Minist. Agric. Argent.* **14** pp. 43–46, 3 figs. Buenos Aires, 1939. [Recd. 1943.]

Rice, which is being grown on a large scale in the lowlands on the bank of the Uruguay river in the Argentine province of Corrientes, is injured, though not to a serious extent, by a Pentatomid of the genus *Mormidea*, the nymphs of which suck the milky grains. The bugs overwinter among weeds and the debris from threshing, emerging on warm days to feed. They leave their winter quarters when the grains are forming in the ears of rice. The eggs are laid on the leaves and development to the adult stage lasts up to about a month. The bugs remain concealed during the day, but can be destroyed by a flame-thrower after dark. A spray of 1·5 per cent. nicotine sulphate or one of kerosene emulsion is effective against the young nymphs. The bugs can also be destroyed, especially during the winter, on trap-crops of oats sown near rice-fields.

LÓPEZ CRISTÓBAL (U.). ***Cydia* (*Laspeyresia*) *molesta*, Busck. Su etología y formas de lucha.** [The Ethology of *C. molesta* and Measures against it.]—*Alm. Minist. Agric. Argent.* **14** pp. 207–215, 10 figs. Buenos Aires, 1939. [Recd. 1943.]

Cydia pomonella, L., on apple and pear, has become less common in Argentina [cf. *R.A.E.*, A **24** 638] and has disappeared from some areas, largely as a result of control by Hymenopterous parasites such as *Ephialtes* (*Calliephialtes*) *argentinus*, Blanch., but *Cydia molesta*, Busck, is becoming more numerous, and it is feared that it cannot be prevented from spreading throughout the country. It prefers peach, but also attacks apple, pear, quince, plum and, in the north, guava. It has 5–8 generations a year, depending on climate [cf. **24** 639; **30** 277], and the first two of these infest the twigs and the others the fruits. Most of the overwintering larvae occur in the soil close to the trunk of the tree and beneath projecting roots, where they are difficult to destroy. Measures are best applied during the oviposition period of the overwintered generation and should be timed by means of emergence cages. The most effective is a spray of 2 per cent. white oil and 0·1 per cent. nicotine sulphate, which kills the adults, eggs and newly hatched larvae. Parasites that are being regularly distributed against the larvae of *C. molesta* include those already noticed [**30** 277] and *Apanteles desantisi*, Blanch.; together they parasitise 40 per cent. in the region of La Plata and 20 per cent. in the delta of the Parana.

MUTINELLI (A.). **Una importante plaga de la yerba mate.** [An important Pest of Maté.]-*Alm. Minist. Agric. Argent.* **15** pp. 169-174, 5 figs. Buenos Aires, 1940. [Recd. 1943.]

An outbreak of *Citheronia (Ceratocampa) brissoti*, Boisd., which is a pest of peach in the northern half of Argentina, occurred on maté [*Ilex paraguensis*] in the Territory of Misiones in 1938. In five days, more than 370 acres were defoliated, with a loss of 100 tons of young shoots. All stages of this moth are briefly described; it has two generations a year, though the second was only partial in 1938, and overwinters in the pupal stage in the soil. The larval stage lasted 30-35 days, and the females laid about 200 eggs at the rate of one per leaf. The larvae were very voracious. The measures of control recommended are hand collection in small foci and spraying or dusting with lead arsenate.

BLANCHARD (E. E.). **El gusano de las semillas (*Hylemyia* spp.).** [Seed Maggots.]-*Alm. Minist. Agric. Argent.* **16** pp. 119-122, 8 figs. Buenos Aires, 1941. [Recd. 1943.]

In Argentina, the germinating seeds and tender shoots of cereal and vegetable crops are attacked by the larvae of *Hylemyia liturata*, Mg. (*sancti-jacobi*, Big.), the most severely injured being wheat, oats, peas, chick peas [*Cicer arietinum*] sunflowers and cucurbits. *H. cilicrura*, Rond., causes similar damage, but is less common and the larvae also destroy locust eggs. The adult flies occur throughout the year, even in mid-winter, and development lasts 1-18 weeks, depending on soil temperatures. Losses can be reduced by avoiding soil rich in organic matter, favourable to breeding, by delayed sowing to ensure rapid germination, and by crop rotation.

D'ANGELO (W. A.). **Mariposa dañina para ciertas plantas de jardín *Xanthopastis timais*, Cram.** [A Lepidopterous Pest of some Garden Plants.]-*Alm. Minist. Agric. Argent.* **16** pp. 169-172, 6 figs. Buenos Aires, 1941. [Recd. 1943.]

Brief descriptions are given of all stages of the Noctuid, *Xanthopastis timais*, Cram., the larvae of which feed on the leaves, bulbs and rhizomes of *Iris* spp., *Crinum americanum*, and *Eucharis grandiflora* in Argentina. The eggs are laid on the lower surfaces of the leaves and the larvae and pupal stages last 22-25 and 20-22 days, respectively. Pupation occurs in the soil. For control, the plants should be examined daily and the eggs destroyed, or they should be sprayed every fortnight, or immediately after rain, with an arsenical such as 2 lb. powdered lead arsenate per 100 gals. water.

MALLO (R. G.). **La lagarta rosada (*Platyedra gossypiella* Saunders). La plaga que mas daño causa a los algodones argentinos.** [The Pink Boll-worm. The most harmful Pest of Argentine Cotton Fields.]-*Alm. Minist. Agric. Argent.* **17** pp. 193-196, 4 figs. Buenos Aires, 1942.

This is a brief account of the bionomics and control of *Platyedra gossypiella*, Saund., on cotton in Argentina, where legislation was passed in 1939 and 1941 prescribing the measures to be taken and recording as heavily infested the provinces of Corrientes and Santiago del Estero and the national territories of Chaco and Formosa.

VERGANI (A. R.). **Un nuevo ácaro parásito de los citrus, *Anychus verganii*, Blinchn.** [A new Mite, *A. verganii*, infesting Citrus.]-*Alm. Minist. Agric. Argent.* **17** pp. 197-198, 5 figs. Buenos Aires, 1942.

A Tetranychid mite observed by the author in 1939 on the leaves of orange in the province of Corrientes, Argentina, was subsequently described by E. E. Blanchard as *Anychus verganii*, sp. n. The adults are described. It infests

sweet and sour orange, mandarin orange, lemon, lime and grape-fruit. Infested leaves become grey or silvered and leathery and tend to curl slightly. The attack is most marked from February to April. Dusting or spraying with sulphur gave effective control.

Boso (J. M.). **Un taladro dañino para nuestros frutales y forestales, *Praxithea derourei* (Chabril).** [A Borer injurious to our Fruit and Forest Trees, *P. derourei*.]—*Alm. Minist. Agric. Argent.* **17** pp. 425–430, 12 figs. Buenos Aires, 1942.

The Cerambycid, *Praxithea derourei*, Chabrilac, which occurs in Brazil, Uruguay and Argentina, attacks ornamental and forest trees and many fruit-trees, and has destroyed entire orchards near the city of Buenos Aires. Its synonymy is discussed, and the adult and larva are briefly described. The adults usually appear in December and January, and the females oviposit between the terminal buds, preferring the highest branches. The larvae bore down to the larger branches and even to the trunk and pupate in their galleries. Development probably lasts one year. Control is effected by cutting off and burning infested branches or by injecting carbon bisulphide into the bore holes, which are then sealed with clay. This should be done before summer, and if necessary should be repeated, not more than 15–20 cc. carbon bisulphide per tree being injected at a time. Similar injury is caused to *Citrus* near Buenos Aires by *Diploschema rotundicolle*, Serv.

HAYWARD (K. J.). **Primera lista de insectos tucumanos perjudiciales.** [First List of Tucumán Insect Pests.]—*Publ. misc. Estac. exp. agric. Tucumán* no. 1, 110 pp. Tucumán, 1943.

This list of 860 harmful insects that occur in Tucumán, Argentina, is arranged alphabetically under their Orders and families, and brief notes are given on their habits, with synonymy and references to the literature in some cases. The majority are pests of crops, but insects that are harmful to man or domestic animals are also included. There is an index to the popular and scientific names of the insects, domestic animals and birds mentioned in the text, and another to those of the plants.

WILLE (J. E.). **Insectos que atacan a las leguminosas cultivadas.** [Insect Pests of leguminous Crops.]—*Vida agric.* **19** no. 222 pp. 347–349. Lima, 1942.

In view of an increase in the cultivation of beans and other pulse crops in Peru, the author briefly reviews the insect pests that attack them. The only one of general importance is *Epinotia opposita*, Heinr., which occurs everywhere along the coast and in the mountains up to about 8,200 ft. Studies on the life-history of this Tortricid [*cf. R.A.E.*, A **30** 566] have shown that the female deposits up to 110 eggs in 5–8 batches on the lower surface of the young leaves. The egg and larval stages last 4–6 days and 2–3 weeks, respectively, and the pupal stage, which is passed in a cocoon in the shoot or on the ground, lasts 8 days in summer and 28 in winter. The life-cycle is completed in 31 days in summer and 60 in winter, and there are eight generations a year. The larvae feed first on the leaves and then bore into the shoots and stems, causing them to dry up. In experiments, the best control was given by a spray of lead arsenate and lime. The other pests dealt with are much less harmful, and the only ones specifically identified are *Heliothis virescens*, F., *Diabrotica decolor*, Erichson, *D. venalis*, Erichson, *Elasmopalpus lignosellus*, Zell., and a few cutworms.

FERREIRA LIMA (A. D.). **Mais um inimigo do *Callosobruchus chinensis*.** [Another Enemy of *Bruchus chinensis*.]—*Bol. Soc. brasil. Agron.* **5** no. 4 pp. 441-443, 1 fig., 1 ref. Rio de Janeiro, 1942.

In 1942, *Bruchus* (*Callosobruchus*) *chinensis*, L., was reared in Santa Catarina from stored seeds of *Phaseolus aureus* (*radiatus*), for which the name cowpea is used in Brazil. Other seeds attacked by this Bruchid in Brazil [cf. R.A.E., A **31** 454] are peas, soy beans and broad beans. Adults of a Pteromalid identified as *Bruchobius laticeps*, Ashm., also emerged from the infested material, and it appeared to give considerable control in a laboratory sample. *Pediculoides ventricosus*, Newp. [cf. **31** 455] also occurred in the culture. Females of *B. laticeps* oviposit on the mature embryos in the eggs just before they hatch. The abdomens of many dead pupae of the Bruchid inside the seeds were completely destroyed, and this is ascribed to the larvae of the parasite.

LEPAGE (H. S.) & GIANNOTTI (O.). **Contribuição para o levantamento fitossanitário do nordeste brasileiro. Coccídeos assinalados nos Estados do Ceará, Paraíba do Norte e Rio Grande do Norte. (Com descrição de 1 espécie nova.)** [A Contribution to the Plant Health Survey of Northeast Brazil. Coccids recorded in the States of Ceará, Paraíba do Norte and Rio Grande do Norte. With a Description of one new Species.]—*Bol. Soc. brasil. Agron.* **5** no. 4 pp. 444-455, 2 pls., 7 refs. Rio de Janeiro, 1942.

Records are given of the finding of 29 Coccids on various plants in north-eastern Brazil, including *Chrysomphalus* (*Melanaspis*) *oliveirai*, sp. n., from the leaves of the oiticica palm (*Licania rigida*) and a species new to Brazil, *Lepidosaphes* (*Aonidomytilus*) *alba*, Ckll., from cassava, both of which are described.

LEPAGE (H. S.) & PIZA (M. T.). **Redescrição do *Neolecanium silveirai* (Hempel) (Homoptera-Coccoidea), séria praga da videira, e seu controle.** [Re-description of *N. silveirai*, a serious Vine Pest, and its Control.]—*Arq. Inst. biol.* **12** pp. 21-26, 2 pls., 2 figs. São Paulo, 1941. (With a Summary in English.) [Recd. 1943.]

The original description of *Neolecanium silveirai*, Hemp., is reproduced and a further description is given of the larva, male and pre-adult and adult female. This Coccid attacks the roots of the grape vine [R.A.E., A **27** 34] and has been observed at a locality in the State of São Paulo at depths down to 3 ft. Complete control was obtained by placing paradichlorobenzene, at the rate of not less than 50 gm. per vine, in a furrow about 8 ins. from the stem. A strong smell of paradichlorobenzene was still perceptible at a depth of 28 ins. after 20 days. Success depends largely on the character of the soil and on dry weather, and both conditions were favourable. Carbon bisulphide was less effective.

AUTUORI (M.). **Contribuição para o conhecimento da saúva (*Atta* spp.—Hymenoptera-Formicidae). I. Evolução do saúveiro (*Atta sexdens rubropilosa* Forel, 1908).** [A Contribution to the Knowledge of *Atta* spp. I. The Development of the Nest of *A. sexdens rubropilosa*.]—*Arq. Inst. biol.* **12** pp. 197-228, 4 pls., 4 figs., 10 refs. São Paulo, 1941. (With a Summary in English.) [Recd. 1943.]

A detailed account is given of observations in Brazil on the development of the nests of *Atta sexdens rubropilosa*, Forel, from the penetration of the ground by the queen to the liberation of the new fertile forms. The various castes of workers were produced 4-10 months after the foundation of the nest, soldiers after 22 months, and the sexual forms after 38 months, at which period the nests appeared to have attained their maximum development.

DO VALLE REGO, (C.) & SOARES BRANDÃO filho (J.). **A saúva e seu combate.** [Leaf-cutting Ants and their Control.]—*Publ. Div. Def. sanit. veg. Minist. Agric. Brasil* no. 17, 22 pp., 16 figs. Rio de Janeiro, 1941. [Recd. 1943.]

The authors describe the bionomics of leaf-cutting ants of the genus *Atta*, which are the most harmful insect pests of agriculture in Brazil. The chief species are *A. sexdens*, L., *A. cephalotes*, L., and *A. laevigata*, F. Sm. It is suggested that a national campaign against these ants should be organised, and measures to be taken by Federal and State governments are proposed. Available measures of control are listed, and it is stated that fumigation of the nests with carbon bisulphide, arsenic or products containing these substances is the only one really effective. An apparatus by which the vapour from carbon bisulphide mixed with air is pumped into the nest, and another by which the fumes from arsenic or arsenic and sulphur [but cf. *R.A.E.*, A 31 415] burnt with charcoal are pumped in, have been officially approved and are described. Carbon bisulphide can also be poured into the nest through a funnel, but this method is less economical.

DE SOUZA MACHADO (A. A.). **A essência de inhamuí, novo inseticida da flora brasileira.** [The Essence of Inhamuí, a new Insecticide of the Brazilian Flora.]—*Bol. Minist. Agric.* 30 no. 5 pp. 33–35. Rio de Janeiro, 1941. [Recd. 1943.]

The essential oil of *Nectandra oleophorum*, a lauraceous plant of northern Brazil, possesses insecticidal properties, and in investigations on its constituents it was found that the fraction distilling between 172 and 210°C. contained, in addition to terpinolene and α -terpinol, 1 : 4 cineole, which is known to be toxic to bacteria and insects. This cineole is an isomer of 1 : 8 cineole (eucalyptol), and the manner in which it was extracted from the fraction is described; the essential oil was found to contain about 2·8 per cent. of it.

ADAMSON (A. M.). **Enemies and Diseases of the Honeybee in Trinidad.**—*Proc. agric. Soc. Trin. Tob.* 43 pt. 1 pp. 37–39, 41–43, 45, 47–49, 51–53. Port-of-Spain, 1943.

The only major insect pest of honey bees in Trinidad is *Galleria mellonella*, L., which is now so prevalent that combs that are not well protected are generally destroyed in a few weeks. An account of its bionomics, including descriptions of all stages, is given, based largely on a paper by Whitcomb [*R.A.E.*, A 24 563]. In the laboratory, females frequently oviposited during the night following emergence and the egg and pupal stages lasted about 9 and 10–12 days, respectively. The construction of the cocoon continues over several days, and, at the time of writing, larvae that began cocoon-formation six weeks previously had become dormant without pupating. It is not known whether this dormant period occurs in the field.

In general, the bees protect the combs from attack, unless the colony is below normal strength; they can be assisted in this by limiting the number of combs, ensuring that all parts of the hive fit closely, and reducing the size of the entrance where necessary. Stored combs are protected by placing the frames in supers arranged in stacks containing 5 deep or 10 shallow supers and sealing all joints with gummed paper. If infested, they should be fumigated before storing and if no sign of infestation is observed they should either be fumigated as a precautionary measure or re-examined two weeks after sealing, when any eggs that were present will have hatched. Carbon bisulphide is the most satisfactory fumigant for use in Trinidad, and is especially suitable for combs containing honey, which is not tainted by it. It should be poured into a dish or on to a pad of absorbent material on the top of the container or stack of supers, the bottom of which must be fairly gas-tight. The height of the stack

should not exceed that of 5 deep or 10 shallow supers, and for this a dosage of 2 fl. oz. is ample. The exposure period should be 12–24 hours, and the treatment should be repeated after two weeks, as all the eggs may not be destroyed. Paradichlorobenzene does not kill the eggs and imparts a strong, unpleasant flavour to the honey.

Other insect pests include *Achroia grisella*, F., which is probably prevalent throughout Trinidad, though nowhere serious, and is controlled by the measures recommended against *G. mellonella*; ants, against which repellent barriers may be required to prevent predacious species from removing the bees and brood; and dragonflies, which occasionally attack the bees, but are probably of little importance. Termites such as *Heterotermes tenuis*, Hag., *Eutermes* (*Nasutitermes*) *costalis*, Hlmg., and *Microcerotermes arboreus*, Emerson, may attack the wood of the hives and stands, and the usual preventive measures should be adopted.

MARTORELL (L. F.). **Forests and Forest Entomology.**—*Caribb. For.* 4 no. 3 pp. 132–134. Rio Piedras, P.R., 1943. (With a Summary in Spanish.)

The insect pests of importance in forests in Porto Rico include *Hypsipyla grandella*, Zell., which has caused the loss of 835,000 mahogany trees [*Swietenia*] and nearly 1,000,000 cedars [*Cedrela mexicana*] since 1935 [cf. R.A.E., A 30 294]; *Asterolecanium pustulans*, Ckll. [cf. 28 524], which is now apparently attacking *Montezuma speciosissima*; and *Apion martinezi*, Mshl., the larvae of which prevent the successful propagation of *Zanthoxylum flavum* by destroying nearly all the seeds. *Kaloterms* (*Cryptoterms*) *brevis*, Wlk., which is troublesome in forests but of more importance as a pest of timber, has increased rapidly during recent years with the increased importation of coniferous building woods, such as sitka spruce [*Picea sitchensis*] and southern pine [*Pinus palustris*] and temperate-zone hardwoods, all of which are susceptible to it.

HARTZELL (A.). **Biology of the Holly Leaf Miner.**—*Contr. Boyce Thompson Inst.* 13 no. 1 pp. 17–27, 4 figs., 28 refs. Menasha, Wis., 1943.

Descriptions are given of all stages of *Phytomyza ilicicola*, Lw., which is indigenous to North America, and is found principally in the Atlantic and Pacific coastal regions, from Massachusetts to Ohio and Alabama and from Alaska to California. Its chief food-plant is *Ilex opaca* (American holly), but it occurs occasionally on other species of *Ilex* including *I. aquifolium* (European holly). The chief injury is caused by the larvae mining the leaves, but oviposition and feeding punctures are also injurious; partial defoliation may follow a severe attack, especially during periods of drought.

Investigation in Yonkers, New York, showed that there is one generation in the year in this area. The egg punctures are scattered widely over the lower surface of the leaves, but many occur near the tip close to the midrib. The larvae form irregular mines just below the upper epidermis and pupate in them after cutting a circular opening, covered with a layer of leaf epidermis, through which the adult emerges [cf. R.A.E., A 26 541]. The adult females are less active than the males, which frequent both surfaces of mature holly leaves, whereas the females occur chiefly on immature leaves. The latter puncture the leaves with the ovipositor for the purpose of feeding, these punctures being confined almost entirely to newly expanded leaves; males placed on tender leaves produced no punctures and died, apparently of starvation, but they lived longer when caged on holly foliage with the females, and probably fed at the punctures made by them. Males and females lived for averages of 2 and 3 days, respectively, under these conditions, and less than a day without food. At Yonkers, the egg stage probably lasts rather more than four days and the larval stage 9–10 months. Adults were present and oviposition occurred in May and June, when the leaves are unfolding from the buds, eggs were present

from the second half of May until the first week in July, larvae from June until April and pupae from the first week in April to the middle of June. Observations on adult emergence [cf. **30** 286] showed that in 1939, 1941 and 1942, when it was relatively dry and warm during early spring, the adults first occurred in the field on 10th–14th May. In 1942, the adult population rose to a peak on 21st May and then decreased gradually until 21st June, when the last flies of the season were seen. An unidentified fungus was observed to parasitise the pupae, but no parasitic insects were reared from infested leaves and no predators were found.

Phytomyza ilicis, Curt., with which *P. ilicicola* has been confused and which is apparently confined to *Ilex aquifolium* [cf. **17** 669], has been reported from several places on the Atlantic coast, but has not become a serious pest there since *Ilex opaca* is the chief species of holly grown in the eastern United States.

HARTZELL (A.), COLLINS (D. L.) & BLAUVELT (W. E.). **Control of the Holly Leaf Miner.**—*Contr. Boyce Thompson Inst.* **13** no. 1 pp. 29–33, 1 fig., 4 refs. Menasha, Wis., 1943.

Experiments on the control of *Phytomyza ilicicola*, Lw., on *Ilex opaca* were carried out in New York in 1942 to compare several recommended treatments with those found promising in preliminary work [cf. *R.A.E.*, A **30** 286]. Sprays of 4 lb. lead arsenate, 1 U.S. qt. nicotine sulphate and 400 cc. Vatsol (10 per cent. aqueous dioctyl ester of sodium sulphosuccinate) per 100 U.S. gals. spray or 1 qt. nicotine sulphate and 2 qts. fish oil per 100 gals. applied on 14th and 25th May and 9th June, reduced the number of mines per 10 leaves in August from 22.5 in the control to 1.3 and 2.2, respectively, whereas a single application of the lead arsenate spray without nicotine sulphate, on 25th May, a dust of 3 per cent. nicotine and lime applied on 21st and 28th May, and a spray of 4 lb. tartar emetic and 6 lb. sugar per 100 U.S. gals. applied on 25th May and 10th June resulted in 19.4, 15.2 and 12.8. Statistical analysis showed the control given by the tartar emetic spray to be almost significant, and this may therefore deserve further testing. Supplementary tests with single applications on 16th and 18th May of lead arsenate and tartar emetic sprays under conditions more closely approximating to those under which holly is generally grown as an ornamental plant gave somewhat inconclusive results.

Consideration of the data from the spray experiments in relation to the seasonal history of the fly [cf. preceding abstract] indicates that a single application of any of the materials tested would not give adequate control of a moderate to heavy infestation if applied several days before the peak of adult abundance or more than a day or two after it, and cannot, therefore, be relied on, owing to the difficulty of timing the spray. Three applications of nicotine sulphate and fish oil gave good control, which was not appreciably improved by the addition of lead arsenate [cf. **30** 286], and it is probable that two would be sufficient in a normal year if one were made two or three days before the peak of adult emergence and the other two or three days after it.

ANNAND (P. N.). **Entomological Problems imposed by War Conditions.**—*J. econ. Ent.* **36** no. 2 pp. 193–200. Menasha, Wis., 1943.

In this general discussion, the author points out that the protection of military personnel from the attack of disease-carrying and other noxious insects is of prime importance in time of war, and that the protection of growing crops and their conservation in storage is both more important and more difficult than in peace time, and gives examples of a number of problems that have arisen in the United States.

HARMAN (S. W.). **Further Studies on Rotenone and other organic Insecticides for Codling Moth Control.**—*J. econ. Ent.* **36** no. 2 pp. 200–204, 1 ref. Menasha, Wis., 1943.

Further field tests carried out in New York in 1942 to compare the relative value of certain organic insecticides and lead arsenate for the control of the codling moth [*Cydia pomonella*, L.] on apple tended to confirm the results obtained in earlier work [cf. *R.A.E.*, A **31** 13]. All amounts given are per 100 U.S. gals. When three cover sprays of the material to be tested were applied against the first generation after one of 3 lb. lead arsenate, and four against the second, those containing 0.75 U.S. pints nicotine sulphate (Black Leaf 40) or 1.5 lb. fixed nicotine (Black Leaf 155) with 3 U.S. pints summer spray oil and 2 oz. blood albumin resulted in 4.5–24.4 superficial and 2.3–7.5 deep injuries per 100 apples, the only noticeable variation in control occurring when the test included different types of oil or a different variety of apple. The corresponding numbers were 23.4 and 1.1 for sprays of 3 lb. lead arsenate, 3 lb. lime and 8 oz. soy-bean flour and 24.1 and 126.6 for untreated trees. Sprays of 2.5 lb. powdered derris root (5.7 per cent. rotenone), 1 U.S. quart oil and an adhesive, alone or with $\frac{1}{2}$ lb. lead arsenate in all seven sprays or 1 lb. lead arsenate in the second, third and fourth, reduced the superficial injuries to 2.2–3.7 and the deep injuries to 1–1.6, but 2 lb. of a proprietary preparation known as Lethane 60-rotenone concentrate and stated to consist of 20 per cent. Lethane 60 [an aliphatic thiocyanate] and 80 per cent. derris or cubé standardised to contain 5 per cent. rotenone, with a spreader, was noticeably inferior, even when 1 U.S. quart oil was included, to the other rotenone sprays. When lead arsenate was included in all the sprays, the residues of arsenic and lead were just above tolerance at harvest, but when it was confined to the first four sprays they were well below. Injury was greater when 2.5 lb. derris with a spreader but without oil was used in six cover sprays after two of 3 lb. lead arsenate than when eight sprays of derris, with oil in all but the first two and $\frac{1}{2}$ lb. lead arsenate in all or 1 lb. in the first four, were applied, and slightly greater when two lead-arsenate sprays were followed by two containing derris and oil and four containing derris and bentonite. A programme of nicotine sulphate and 1 lb. lead arsenate against the first generation and derris and oil against the second gave good control of *C. pomonella* without leaving objectionable residues and might be effective against the apple maggot [*Rhagoletis pomonella*, Walsh]. Pyrethrum, in the form of the ground flowers or an extract (Pyroicide 20), was less effective than nicotine or rotenone. The production of a uniform spray deposit is discussed [cf. **31** 304]. To evaluate the spreaders used, a 1 per cent. summer oil was applied to foliage with each of them and alone. All of them left appreciable deposits of oil in approximately equal amounts, and the application without a spreader deposited about 40 per cent. less oil.

PARKER (R. L.) & LAMERSON (P. G.). **Lead Arsenate and Tricalcium Arsenate Combinations for the Control of Codling Moth.**—*J. econ. Ent.* **36** no. 2 pp. 205–210, 1 ref. Menasha, Wis., 1943.

During 1940, severe scorching of foliage occurred in Kansas on Jonathan apple trees that were sprayed with lead arsenate for the control of the codling moth [*Cydia pomonella*, L.], except when 4 oz. zinc sulphate per 100 U.S. gals. water was added to the spray, and in 1941, although arsenical injury to this variety was less severe, a spray of 4 lb. lead arsenate, 1 U.S. quart summer oil and 4 oz. zinc sulphate per 100 U.S. gals. water was the least injurious. In 1942, tests were made of nine cover sprays consisting of lead arsenate (4 lb. per 100 U.S. gals.) alone or with the addition of 4 oz. zinc sulphate or 2 oz. bentonite. Summer oil (1 U.S. quart) was added to the first two, three, four or five cover sprays of lead arsenate and zinc sulphate and a

commercial mixture (Tritox) of tricalcium arsenate and bentonite (at 4 lb. per 100 U.S. gals.) was also tested. Bordeaux mixture (1 : 2 : 50) was added to the sixth cover spray for the control of fungous disease. The tricalcium-arsenate spray was the least effective of those tested, resulting in an average of only 34.1 per cent. undamaged fruit and more severe scorching than any other material. Lead arsenate alone and with Wyoming bentonite gave 79 and 80.2 per cent. uninjured fruit respectively. The sprays containing zinc sulphate gave 80.8–86.3 per cent. with less scorching and defoliation than the other treatments. The number of superficial injuries was low on all plots sprayed with lead arsenate; the inclusion of oil reduced the number, and the decrease tended to be greater as the number of sprays containing oil was increased. The fruit treated with sprays containing zinc sulphate matured later, owing to the good condition of the foliage, and had less colour than that from other plots. However, a grower who used this treatment applied a hormone spray when the fruit began to drop rapidly, with the result that it remained on the tree until adequate colour was obtained. All samples of harvested apples had more than the legal tolerance of 0.025 grain arsenic per lb. fruit, but washing for 2½ minutes in 3 per cent. hydrochloric acid at a temperature of 35°C. [95°F.] reduced it to less than 0.001 on fruit treated with tricalcium arsenate, 0.009 and 0.01 on that treated with lead arsenate, alone and with bentonite, respectively, and 0.015, 0.02, 0.023 and 0.025 on that receiving oil in the first three, two, four and five cover sprays.

GARMAN (P.). **Studies of reduced Schedules for Control of Apple Insects in Connecticut.**—*J. econ. Ent.* **36** no. 2 pp. 211–214. Menasha, Wis., 1943.

A spray of hydrated lime, lead arsenate and fish oil having resulted in good apple crops in Connecticut on varieties not subject to scab, with no objectionable residue at harvest, but some foliage injury at times, its adhesive properties were investigated in 1939–42. It was found that the substitution of such materials as aluminium sulphate for the fish oil gave equally good adhesion, good control of insects and less foliage injury, and that aluminium acetoborate, unlike the sulphate, made the spray safe without the lime. The addition of a small amount of benzoic acid to aluminium acetoborate [*cf. R.A.E.*, **A 30** 549] resulted in a soapy solution, probably owing to the formation of alumina gel, in which white summer oils were emulsified; sprays of an emulsion of this kind containing 3 lb. lead arsenate per 100 U.S. gals. remained on the trees for a long time without scorching the foliage, even in wet weather, and gave satisfactory control. After application on 17th and 29th May and 12th June, the arsenic deposit on the foliage on 16th September was 74 per cent. of that present on 16th June, as compared with 56.4 per cent. from an ordinary inverted spray (Western dynamite) [*cf. loc. cit.*].

Laboratory tests in which glass slides were coated with various mixtures in a settling tower and washed with distilled water showed that both alumina and silica gels improved the adhesion of lead-arsenate sprays, with or without oil, that the addition of talc to lime and certain other materials also increased adhesion, and that sprays containing lead arsenate and a fungicide (sulphur) adhered well when combined with alumina gel.

In 1941, lead arsenate in three sprays of aluminium acetoborate with benzoic acid and oil gave much better control of apple maggot [*Rhagoletis pomonella*, Walsh] than in four of sulphur and comparable control of curculio [*Conotrachelus nenuphar*, Hbst.] on four of six plots. On trees not liable to scab there was little difference in the amount present, but it was much heavier after the aluminium acetoborate sprays on susceptible varieties. In 1942, a spray of lead arsenate and oil with aluminium acetoformate and small quantities of manganese borate and benzoic acid gave no better adhesion than one of lead arsenate and oil alone, but resulted in a heavier residue throughout the season than lead arsenate with

flotation sulphur or with talc, lime and oil, less russetting than any spray but the last, and less foliage injury than any but lead arsenate and flotation sulphur ; and three sprays of lead arsenate, aluminium acetoformate and oil, with a doubled concentration of lead arsenate in two of them, gave percentages of uninjured fruit comparable with those obtained from five of lead arsenate and sulphur. A spray of lead arsenate, lime-sulphur, soy-bean flour and manganese borate is said to have resulted in fruit of good quality and relatively free from russet in two Connecticut orchards.

SMITH (C. F.). **Experiments with the Peach Tree Borer in North Carolina.**—*J. econ. Ent.* **36** no. 2 pp. 215–218, 6 refs. Menasha, Wis., 1943.

An account is given of work carried out in North Carolina in 1939–42 to determine the relative effectiveness of ethylene-dichloride emulsion and paradichlorobenzene for the control of the peach tree borer [*Aegeria exitiosa*, Say] on peach, their effect on the trees, the best time to apply them, and the effect of mounding when ethylene-dichloride emulsion is used. Paradichlorobenzene was applied at rates of 1 oz. to trees 6 years old or more, and 0.75, 0.5, 0.25 and 0.125 oz. to those 4–5, 3, 2 and 1 year old, as crystals or in a 15 per cent. solution in oil, in a ring 1–2 ins. from the trunk made in loose soil piled up 2–3 ins. high, so that the poison was above most of the larvae, and covered with 3–4 shovelfuls of soil. Ethylene-dichloride emulsion was applied at rates of 0.5 U.S. pint 25, 20 and 15 per cent. emulsion to trees 6, 4–5 and 3 years old, and 0.125 U.S. pint 7.5 per cent. emulsion to those 1–2 years old, by breaking the crust of soil immediately round the tree, pouring the emulsion on the base of the tree, and, in some cases, covering it with 2–4 shovelfuls of soil.

The results showed that ethylene dichloride gave better control than paradichlorobenzene when applied on or after 25th September, when some moths were still present, and that applications were effective when made up to 16th February. Paradichlorobenzene should not be used after 25th October, since it is less effective in cold weather, and both materials are best used between 1st and 15th October, in North Carolina, as this is late enough to kill the larvae that hatch late and prevents additional damage. It was advantageous to mound the trees when applying the emulsion, but unnecessary to pat down the mound in sandy soil, and a small mound was as effective as a large one. Observations of tree injury indicated that ethylene-dichloride emulsion, when used at the correct concentration and dosage, is as safe as any other material that controls the larvae.

PYENSON (L.). **A destructive Apple Sawfly new to North America.**—*J. econ. Ent.* **36** no. 2 pp. 218–221, 3 figs. Menasha, Wis., 1943.

Late in May 1939, larvae of a sawfly, later identified as *Hoplocampa testudinca*, Klug, were found in the young fruits of a number of varieties of ornamental crab apples and in a few wild apple trees on Long Island, New York ; the same species was found on apple on Vancouver Island, British Columbia, in 1940 [*cf. R.A.E.*, A **31** 211]. Damage was observed in an adjacent orchard on Long Island in 1941 and 1942, none of the 24 varieties present being immune, and injured apples were received from other districts. In one case a pear was attacked, and P. J. Chapman of the New York State Experiment Station had informed the author in 1939 that he had found unidentified sawfly larvae boring in pears. Early blooming varieties of apples were the most severely attacked.

In 1942, the adults emerged from the ground between 4th and 12th May, during the flowering period of the early varieties, and appeared to be most abundant near the tops of trees in heavy bloom [*cf. loc. cit.*]. The eggs were deposited in slits in the inner wall of the calyx, usually one, but occasionally two in one apple, and some had hatched two weeks after the first appearance

of the adults. The larvae fed within the calyx for a little while before making a number of short tunnels under the skin of the apple, which they entered through the calyx or at the side, and later hollowed out the centre of the fruit. They destroyed 2-6 apples each. When full-grown, about three weeks after hatching, the larvae either leave the apple and descend to the ground or drop with the apple and leave it later. Larvae were found in newly fallen apples until 19th June. They constructed pupal cases in the soil, in which they remained in the prepupal stage until early in the next spring. The sawfly was probably introduced in the prepupal stage in soil round the roots of ornamental plants and appears to find seasonal conditions favourable and to be well established in North America. Although there is only one generation in the year, damage is severe because each larva may destroy several apples, though in some varieties that produce heavily and require thinning, infestation may be less serious.

Observations on the effect of the regular spray schedule on this species indicate that calyx, curculio and first cover sprays containing the standard materials recommended for eastern New York, which are applied at times suitable for its control, have little value. A spray containing 3 lb. lead arsenate per 100 U.S. gals. water proved toxic to young larvae, but evidently coverage was not sufficiently thorough in the orchard. In laboratory tests, 4 lb. derris powder (4 per cent. rotenone) per 100 U.S. gals. water gave very promising results against young larvae, most of which died on coming into contact with sprayed apples and did not attempt to enter them. A supplementary method of control would be to collect and destroy the larger fallen fruits for 10 days after the larvae reach full growth (about 7th June).

DRIGGERS (B. F.) & HANSENS (E. J.). **The Comstock Mealybug on Apples and Peaches in New Jersey.**—*J. econ. Ent.* 36 no. 2 pp. 222-226, 3 refs. Menasha, Wis., 1943.

During November 1941, apples from two orchards in different counties in New Jersey showed a heavy deposit of black sooty fungus; observations on the trees in early December revealed the presence of numerous egg masses under the bark and in crevices on the trunk and branches, and examination of adult females collected in the summer of 1942 showed that the insect concerned was *Pseudococcus comstocki*, Kuw. In an orchard in a third county, peach trees that adjoined old infested apple trees were found to be heavily infested with egg masses and migrating adults in August 1942, and 50 per cent. of the fruits were affected. Since mealybugs, apparently of the same species, were collected in other orchards, *P. comstocki* appears to be generally distributed in the State. In the two apple orchards, infestation was practically confined to trees approximately 40-45 years old that were in vigorous growth. The peach trees were about 25 years old and in good condition and the adjoining apple trees 50 years old and abandoned. Infestation was much heavier on the peach trees near the apples, and very few mealybugs were found on the latter; it appears, therefore, that the infestation had originated on the apple trees and spread to the peaches as the apples deteriorated. Two generations and a partial third were observed in central and southern New Jersey in 1942. The date of hatching of the overwintered eggs was not observed, but nymphs in the first and second instars were present on 21st May. Migrating female adults of this generation were abundant on 23rd and 30th June, and mature females of the following generation were found between 26th August and 3rd September. Egg masses collected during the last week in August hatched within a week. Mealybugs in various stages of development were found in the peach orchard on 15th October and mealybugs in the second and third instars and adults in the apple orchards on 28th October.

Consignments of *Allotropa* sp. [cf. *R.A.E.*, A 31 308, 464] and *Pseudaphycus* sp., which were introduced from Japan against the mealybug and have been extensively colonised in Virginia, were received from the latter State in 1942; both were released on 1st June and 7th August in both apple orchards. Batches of adult migrating females collected on 23rd and 30th June and on 28th August and 3rd September showed 10.3–28.6, 0–1.6, 10.1–41.9 and 18.1–55.4 per cent. parasitism, respectively. In addition to both the introduced species a native parasite, *Clausenia* sp., was recovered from all the plots examined. The fruit was much less severely damaged by *Pseudococcus comstocki* during 1942 than during 1941, probably owing to the combined effect of the parasites, dry weather in late summer and autumn and a change in tree growth due to reduction in the amount of fertiliser, particularly nitrogen, used.

CASSIL (C. C.), WADLEY (F. M.) & DEAN (F. P.). **Sampling Studies on Orchard Spray Residues in the Pacific Northwest.**—*J. econ. Ent.* 36 no. 2 pp. 227–231, 2 figs., 5 refs. Menasha, Wis., 1943.

The results are given of a statistical study of spray-residue variance, made in a representative apple orchard in Washington during 1940 to determine the best practical sampling technique for use under conditions in the Pacific Northwest. Apples were collected from trees in three plots in different parts of an orchard, and three samples of five apples were taken at random from the top, middle and bottom of each tree immediately before and after each of six cover sprays. Lead arsenate was used for all sprays, and the entire apple was used for the recovery of residue. The deposits before spraying reflected the effect of previous sprays, weathering and fruit growth, whereas those after spraying were larger by the amounts added by the sprays. Consideration is given to variation between plots, between trees within plots, between levels in the trees, between spray applications and between samples within sub-classes, and it is concluded that arsenic deposits measured after spraying are more variable than those measured before spraying and are somewhat erratic in variation; variation between sections of the tree barely reaches significance and may be allowed for in sampling. Trees within plots vary nearly as much as plots and definitely more than samples within trees, and it is therefore concluded that more gain in sampling precision will come from increasing the number of trees per treatment than the number of apples per tree.

FLEMING (W. E.), BAKER (F. E.) & KOBLITSKY (L.). **Effect of Lead Arsenate in Soil on Vegetables.**—*J. econ. Ent.* 36 no. 2 pp. 231–233. Menasha, Wis., 1943.

Since larvae of *Popillia japonica*, Newm., have damaged garden vegetables, particularly on land in the heavily infested area that had been in sod the previous season, preliminary experiments were carried out in the greenhouse and field in New Jersey in 1933 and 1934 on the effect of adding lead arsenate to the soil, which has given good control on lawns and golf courses for several years, on the germination, seedling growth and yield of many of the common garden vegetables and on the amount of arsenic assimilated in their edible portions. Lead arsenate was thoroughly mixed with sandy loam at rates equivalent to incorporating 1,000, 1,500 and 2,000 lb. material with the upper three inches of an acre of soil, and 200 seeds of each of the vegetables to be tested were sown in untreated soil and in each treated one. The germination of most of the vegetables was unaffected even in soil containing 2,000 lb. lead arsenate per acre, but that of beets, muskmelon and spinach was 12–14 and 13–22 per cent. less in soil containing 1,000 and 2,000 lb., respectively, than in untreated soil, and that of lima beans and string beans was reduced by 63 and 28 per cent., respectively, in soil containing 1,000 lb. and 98 and 40 per cent. in

that containing 2,000 lb. Examination 30 days after sowing showed very slight differences in growth in untreated soil and that containing lead arsenate for asparagus, onion, hot and sweet peppers [*Capsicum*], pumpkin, spinach, tomato and watermelon, but the remaining crops were retarded. In field tests in 1933, in which lead arsenate was applied at 1,000, 1,500 and 2,000 lb. per acre and thoroughly mixed with the top three inches of soil, lima beans germinated but died, and the early growth of all the other vegetables was retarded by treatment, but after the roots had penetrated below the zone of arsenic contamination, the plants appeared to develop normally and, with the possible exception of onions, they showed no reduction in yield. In 1934, when 2,000, 3,000 and 4,000 lb. lead arsenate per acre was incorporated with the upper six inches of soil, lima beans and string beans did not grow in the treated plots and turnips did not reach maturity; the yields of cabbage, carrot, maize, cucumber, lettuce, muskmelon, onion, parsnip, pumpkin and radish were reduced, but there seemed to be little difference in the yield of treated and untreated beet, egg-plant [*Solanum melongena*], sweet pepper, potato, sweet potato and tomato. Little arsenic was found in the edible portion of most of the vegetables grown in the treated soil. The greatest quantities were found in onion, radish, lettuce and turnip, but only the first two assimilated more than 0.019 grain per lb. from the treatment with 2,000 lb. to a depth of 6 ins.

FLANDERS (S. E.). **Mass Production of the California Red Scale, and its Parasite *Comperiella bifasciata*.**—*J. econ. Ent.* **36** no. 2 pp. 233–235, 3 refs. Menasha, Wis., 1943.

The author describes the technique used for the mass production of *Aonidiella aurantii*, Mask., and its parasite, the Chinese race of *Comperiella bifasciata*, How., in the laboratory in California in 1941–42. The Coccids are best bred on grapefruits and transferred to harvested fruits of banana squash, which support infestations for 4–5 months when kept under suitable conditions. By this means, over two million adults of the parasite were produced in the year.

HAMILTON (C. C.). **The Pine Sawfly *Neodiprion sertifer* Geoff. and its Control with concentrated Lead Arsenate Sprays.**—*J. econ. Ent.* **36** no. 2 pp. 236–240, 4 figs., 4 refs. Menasha, Wis., 1943.

The author gives a short account of the bionomics of *Neodiprion sertifer*, Geoffr., which has become increasingly abundant in New Jersey since 1937 and has caused extensive defoliation of several species of pine planted for timber and for watershed protection [*cf.* *R.A.E.*, A **28** 487], and describes experiments carried out on its control with concentrated sprays of lead arsenate. The tests made in 1941 have already been noticed [**30** 483]. In 1942, it was found that some of the trees sprayed in 1941 were practically uninjured, but others showed an increase in the number of twigs damaged, owing to reinfestation from unsprayed areas, and it is therefore concluded that it is necessary to spray an entire area to prevent serious and rapid reinfestation. In 1942, a spray of 16 lb. lead arsenate and 1 U.S. gal. of a quick-breaking emulsified fish-oil spreader per 100 U.S. gals. water was applied on 11th–14th May throughout the same area, with the exception of about four acres that could not be penetrated by the sprayer, at a rate varying from approximately 60 U.S. gals. per acre for small trees to approximately 125 U.S. gals. per acre for the largest ones. On 21st and 22nd May, examination of the sprayed trees showed very good control wherever coverage had been obtained, and in October there were very few eggs, even in the unsprayed area.

CHAPMAN (P. J.), PEARCE (G. W.) & AVENS (A. W.). **Relation of Composition to the Efficiency of Foliage or Summer Type Petroleum Fractions.**—*J. econ. Ent.* **36** no. 2 pp. 241–247, 2 figs., 9 refs. Menasha, Wis., 1943.

The following is based on the authors' summary. A number of petroleum fractions of summer-type spray oils with viscosities ranging from about 54 to 80 secs. Saybolt at 100°F. and emulsified with blood albumin were tested to compare their toxicity to eggs of the oriental fruit moth [*Cydia molesta*, Busck], the codling moth [*C. pomonella*, L.] and *Spilonota ocellana*, Schiff., on apple and quince in the laboratory. Efficiency was found to be related to the chemical composition of the oils, the oil most predominantly paraffinic in character being ten times more efficient than some of the naphthenic type. Contrary to common belief, highly refined or white oils were more effective than the corresponding less refined products, efficiency being increased with the removal of the aromatic constituents. The three species of insects studied showed no significant difference in their response to the oils tested.

LANGFORD (G. S.), MUMA (M. H.) & CORY (E. N.). **Attractiveness of certain Plant Constituents to the Japanese Beetle.**—*J. econ. Ent.* **36** no. 2 pp. 248–252, 11 refs. Menasha, Wis., 1943.

In view of the reduction in the supplies of geraniol and eugenol available for use in baits for the Japanese beetle [*Popillia japonica*, Newm.] in the United States, attempts were made in Maryland to find substitutes for them. The data collected so far indicate that there are probably many chemicals, particularly those of plant origin, that are attractive to the beetle. Their attractiveness is given as a figure (in brackets) expressing the number caught as a percentage of those caught by the standard mixture of 90 parts geraniol and 10 parts eugenol. Of the essentially pure chemicals, the best attractants were found among the alcohols; geraniol (68·3) and eugenol (62·6) were the best, but citronellol (15·94), phenyl ethyl alcohol (8·2) and linalool (9·15) were also attractive. Several of the higher fatty acids were decidedly so; caproic acid (28·66), propionic acid (33·12) and valeric acid (38·76) appeared to be the best of those tested; concentrated acetic acid (2·5) did not appear to be attractive, but seemed to enhance the attractiveness of certain other materials when diluted and added to them, and butyric acid (22·07) was somewhat attractive. Of the essential oils tested, pimento oil (54·04) was the most effective and the oils of citronella (26·35), bay (18·68), coriander (24·32), clove (20·75), sassafras (20·09), rose geranium (15·97), lemon grass (13·3) and linaloe (9·23) were attractive. Among the esters and aldehydes, methyl salicylate (7·8) and benzaldehyde (5·94) were slightly attractive. Combinations of these attractants were, on the whole, more effective than the constituents used separately. This was true for mixtures of alcohols and phenols, oils and alcohols, oils and acids and oils and oils. In 19 different combinations, 15 were more and four less attractive than any one constituent, and in five cases, the combinations were more attractive than the combined values of all the attractants in the mixture. When comparatively pure chemicals such as eugenol, caproic acid and valeric acid were combined in equal volume with another substance, the attractiveness of the mixture approached or slightly exceeded the sum of the values of the two substances. In some instances, mixtures of unequal volumes exceeded in value the sum of the values of the constituents. Wide variations occurred when some of the essential oils were mixed, probably because they are of a complex chemical nature and may contain ingredients that repel beetles or mask attractive ingredients. A mixture of 75 parts geraniol and 25 parts eugenol caught 8·48 per cent. more beetles than the standard mixture, and one of equal parts 99·38 per cent. as many. Oil of pimento and eugenol (90 : 10) caught 95·02 per cent. as many, and the other baits that caught more than

70 per cent. were mixtures of caproic acid and oil of pimento (1 : 1) and valeric acid and oil of bay (90 : 10).

JEFFERSON (R. N.). **Influence of Carbon Tetrachloride on the toxic Efficiency of certain volatile organic Compounds.**—*J. econ. Ent.* **36** no. 2 pp. 253–259, 6 figs., 32 refs. Menasha, Wis., 1943.

The author describes laboratory tests carried out to determine the effect of carbon tetrachloride on the toxicity of methyl bromide, methyl formate and ethylene dichloride to adults of *Tribolium castaneum*, Hbst. The gases were first tested separately; the concentrations in mg. per litre required for 50 and 99 per cent. mortality with exposure of two hours at 30°C. [86°F.], determined from the dosage-mortality curve, were 14 and 17.5 for methyl bromide, 28 and 43.4 for methyl formate, 95.5 and 149.5 for ethylene dichloride, and 105.5 and 209.1 for carbon tetrachloride. The last two did not differ significantly in toxicity at concentrations that kill less than 42 per cent. Carbon tetrachloride was then mixed with each of the other gases in the proportion of their median lethal concentrations and of three times the median lethal concentration of each constituent to the median lethal concentration of the other, and the dosage mortality curves for the mixtures were obtained. In no case was there evidence of an increase in toxicity, and there was a decrease in the 1 : 1 and 3 : 1 mixtures of carbon tetrachloride with methyl formate or ethylene dichloride. The necessity for modifying the method for the quantitative analysis of synergistic action described by Bliss [*cf. R.A.E.*, A **28** 200] and the generalisation of his formula for similar action suggested by Finney [*cf. 30* 501] is discussed.

The test insects were obtained from stock cultures started from a natural population, and during the 4½ months of the experiment they showed a significant decrease in resistance to ethylene dichloride, a reduction in the rate of increase of mortality with increasing concentrations of carbon tetrachloride and no significant change in resistance to methyl formate.

DONOHUE (H. C.). **Development of new Methyl Bromide Fumigation Schedules for Use against Japanese Beetles.**—*J. econ. Ent.* **36** no. 2 pp. 260–262, 2 refs. Menasha, Wis., 1943.

The tests described were carried out in view of the success in the United States of fumigation with methyl bromide for the control of adults of *Popillia japonica*, Newm., in vegetable produce in refrigerator cars and trucks for rail and road transport [*cf. R.A.E.*, A **31** 343, etc.]. Fumigation was carried out in experimental vaults, and the information obtained was used as a basis for prospective new or altered schedules, which were then tested in refrigerator trucks and cars and van-type trucks, of which all visible openings were covered with masking tape, and under duck covers treated with ethyl cellulose. No evidence was obtained of reduced effectiveness due to the presence of a load of any of the fruits or vegetables requiring treatment. Complete mortality within 24 hours was obtained by fumigation for two hours with all the dosages tested, except in some of the preliminary vault fumigations, and it is concluded that treatment for this time with 2.4, 2, 1.6, 1.2 and 0.8 lb. methyl bromide per 1,000 cu. ft. at 60, 68, 77, 86 and 95°F., respectively, will give effective mortality of *P. japonica* in produce in cars and trucks of the types tested and under a gas-proof duck cover.

KING (H. L.) & FREAR (D. E. H.). **Relation of Chemical Constitution of some N-heterocyclic Compounds to Toxicity to *Tetranychus telarius* (L.).**—*J. econ. Ent.* **36** no. 2 pp. 263–265, 5 refs. Menasha, Wis., 1943.

The following is substantially the authors' summary. The results of laboratory tests with eight N-heterocyclic compounds related to pyridine

as contact sprays against *Tetranychus telarius*, L., indicated that the addition of one or two methyl groups did not increase the toxicity of the pyridine nucleus; that the addition of an amino group in the α -position markedly increased the toxicity of the molecule to the mite; and that the condensation of the pyridine nucleus with a benzene ring to form quinoline resulted in increased toxicity, and condensation with two benzene rings to form acridine in a further increase. The order of toxicity of the compounds tested was as follows: pyridine = α -picoline = β -picoline = 2-6-lutidine < 2-methyl-6-amino-pyridine = 2-amino-pyridine < quinoline < acridine, and this order was found to be nearly the same as the increasing order of boiling points.

TURNER (N.). **The Effect of Diluents on the Toxicity of pure ground Derris Root in Dusts.**—*J. econ. Ent.* **36** no. 2 pp. 266–272, 6 figs., 18 refs. Menasha, Wis., 1943.

Since previous workers have shown that the diluent used with ground derris and cubé roots may have a chemical or physical effect on the toxic materials in the roots, several diluents commonly used for such dusts were compared. In laboratory tests, leaves of greenhouse nasturtiums infested with *Aphis rumicis*, L., were exposed to the dusts in a settling tower. Pyrophyllite and clay showed little or no toxicity alone, and in tests to compare a series of dosages of undiluted ground derris root (4 per cent. rotenone) with mixtures containing the same quantity of derris there was no significant difference between the results with clay and fibrous talc, neither of which affected toxicity, but pyrophyllite definitely increased the toxicity at the lower concentrations [cf. R.A.E., A **30** 604]. In another series, there was little difference between flaky talc and a slate dust, but pyrophyllite was much more effective. In cage tests with a series of concentrations of derris in pyrophyllite and clay, mortality of the striped cucumber beetle [*Diabrotica melanocephala*, F.] on potted squash plants was very variable, probably owing to the injuries received in collecting and treating, but dusts containing pyrophyllite were distinctly more toxic than those containing clay. In field tests with these dusts, the respective rotenone contents of pyrophyllite and clay dusts giving 80 per cent. control of the potato flea beetle [*Épirix cucumeris*, Harr.] on potato were 0.35 and 0.9 per cent.; those of dusts that gave 80 per cent. protection of bean foliage from the Mexican bean beetle [*Epilachna varivestis*, Muls.], when applied on 28th July against the adults and 8th and 18th August against the larvae, were 0.25 and 0.9 per cent., 0.125 and 0.5 per cent., giving excellent commercial control; and those producing 70 per cent. marketable heads of cabbage when applied to plants infested lightly with the imported cabbage worm [*Pieris rapae*, L.] and diamond-back larvae [*Plutella maculipennis*, Curt.] and moderately to severely with the cabbage looper [*Plusia brassicae*, Ril.] were 0.35 and 1 per cent.

GUNTHER (F. A.). **Effects of Oxygen and Sunlight on Decomposition of Rotenone in Spray Mixtures.**—*J. econ. Ent.* **36** no. 2 pp. 273–281, 4 figs., 29 refs. Menasha, Wis., 1943.

A review of the literature indicates that rotenone is very readily decomposed by the action of sunlight, both in the presence of oxygen and in its absence, but that the presence of oxygen may produce a secondary effect and that decomposition due to the action of atmospheric oxygen alone is not improbable, particularly when the rotenone is in an alkaline medium. Quantitative investigations were therefore carried out on the extent and nature of the oxidative decomposition and photo-sensitivity of rotenone in certain spray mixtures. In the first experiment, two bottles of a stock solution of 0.82 lb. powdered whole derris resin (30 per cent. rotenone) and 4 lb. Cardolite 627 in

14.5 lb. kerosene, to one of which enough hydroquinone was added as an anti-oxidant to make 1.5 per cent. of the whole by weight, were stored in the dark at a temperature of 19–27°C. [66.2–80.6°F.]. The Cardolite 627, a condensation-polymer of the phenolic constituents of cashew-nut-shell oil (cardanol) and formaldehyde, was used because it was in favour at the time as a mutual solvent for sprays containing derris resin or pure rotenone and oils. Analysis of samples taken from each bottle before storing and at approximately monthly intervals afterwards for rotenone and deguelin content showed that the addition of hydroquinone retarded decomposition considerably, the decrease after seven months being only one-thirtieth as much in the presence of the anti-oxidant as without it. The observed loss of toxic constituents was probably due to the oxidative reaction of the air in contact with the spray concentrate and in solution with it. In the second experiment, seven rotenone-containing mixtures were subjected to direct afternoon sunlight in shallow dishes, and samples taken before exposure and after exposure for 20–23, 60 and 100 minutes were analysed. The decomposition percentages after 100 minutes were 43 for the stock solution diluted with kerosene (1 : 70), 96 for a saturated solution of pure rotenone in kerosene, 82 for an extract of 1.18 gm. powdered derris root (6 per cent. rotenone) in 236 cc. kerosene, only 20 for a stock solution of the same proportions as the first one, but prepared with a light-medium oil instead of kerosene, and 67, 44 and 33, respectively, for saturated solutions of pure rotenone and whole derris resin (30 per cent. rotenone) and a saturated extract of powdered derris root (6 per cent. rotenone) in a light-medium oil. It is therefore evident that direct sunlight produced a very striking photodecomposition of rotenone, both in kerosene and in the light-medium spray oil, but the addition of Cardolite to any solution and the use of whole derris resins or derris extract in other than kerosene solutions markedly decreased the rate of this decomposition. It is concluded that for maximum efficiency, any spray preparation containing rotenone or its congeners should be protected as much as possible from the action of sunlight, the oxygen in the air and high temperatures.

WALKER (H. G.) & ANDERSON (L. D.). **Pea Aphid Control in eastern Virginia in 1942.**—*J. econ. Ent.* **36** no. 2 pp. 281–285, 2 refs. Menasha, Wis., 1943.

Nicotine- and rotenone-bearing dusts have given variable control of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on peas in eastern Virginia [*cf. R.A.E., A* **29** 504], and experiments were therefore carried out in 1942 to develop a more reliable dust that could be applied with the equipment now available and would replace or conserve supplies of rotenone. Comparisons were made of dusts of cubé and pyrophyllite, alone and in combination with Lethane 60 (an aliphatic thiocyanate), and various nicotine dusts, alone and in combination with cubé, applied with dusting machines fitted with cloth trailers. In the first test, mixtures of Lethane and cubé, containing as little as 0.2 per cent. rotenone and 3 per cent. Lethane, were as effective as cubé dusts containing 0.75–1 per cent. rotenone; a dust containing 3 per cent. Lethane alone was more effective than a cubé dust containing 0.2 per cent. rotenone; cubé dusts containing 0.75 and 1 per cent. rotenone were equally effective and superior to those containing 0.2 and 0.4 per cent. In this and in one of the later tests, cubé dust containing 0.75 per cent. rotenone was not made more effective by the addition of 2 per cent. ground-nut oil and 1 per cent. Vatsol OS. In the second test, dusts of Black Leaf 10 (finely ground tobacco stems impregnated with 10 per cent. by weight of free nicotine) with pyrophyllite or cubé and pyrophyllite, Black Leaf 155 (nicotine bentonite containing 14 per cent. nicotine) with hydrated lime, Black Leaf 40 (40 per cent. nicotine sulphate) with hydrated lime and monohydrated copper sulphate, and cubé and pyrophyllite, alone or with Lethane 60, all gave significant decreases in Aphid populations,

but the results were so variable that there was little significant difference between treatments. In another test with similar dusts, however, those containing 3 and 0.25, 3 and 0.5 and 2 and 0.5 per cent. nicotine from Black Leaf 10 and rotenone, respectively, in pyrophyllite were about equally effective and more so than the 3 and 4 per cent. nicotine dusts without cubé, with one exception. A cubé dust containing 0.75 per cent. rotenone was only slightly more effective at 60 lb. per acre than at 41 lb. per acre, and a cubé dust containing 0.4 per cent. rotenone and 3 per cent. Lethane was as effective as the 0.75 per cent. dust, but one containing 0.2 per cent. rotenone and 3 per cent. Lethane was probably rather less effective. In further tests, dusts of Black Leaf 10 in hydrated lime (4 per cent. nicotine), and of pyrophyllite, sulphur (25 per cent.) and cubé (to give 0.75 per cent. rotenone) were about equally effective, distinctly superior to Black Leaf 155 in hydrated lime (4 per cent. nicotine), and inferior to Black Leaf 10 (2 per cent. nicotine), cubé (to give 0.5 per cent. rotenone) and 25 per cent. sulphur in pyrophyllite.

JOHNSTON (J. P.). **The Effect of the Hot Water Treatment for Cyclamen Mite upon Cyclamen Plants.**—*J. econ. Ent.* **36** no. 2 pp. 286-289, 7 refs. Menasha, Wis., 1943.

In investigations in Connecticut on the treatment of potted cyclamen with hot water for the control of *Tarsonemus pallidus*, Banks, plants that were wholly submerged in water at a temperature of 110°F. for 15 minutes in the first half of December 1938 were all injured, some severely, but, apparently with only one exception, all mites and eggs were destroyed. The same treatment was carried out in August 1939 with no damage to the plants. Since these treatments indicated that the reaction of the plants varied greatly and that injury occurred and increased as they approached maturity, a series of seven treatments was made in 1941 with six varieties of cyclamen in different stages of growth. All the plants were successfully treated at intervals before flowering buds appeared, but as soon as the plants became pot-bound and plant growth was checked or flower buds were produced, the treatment caused a noticeable number of buds and leaves to wilt. The greatest injury and loss of plants occurred in October, November and early December, when the plants were in various stages of bud and bloom. It is concluded that injury due to hot-water treatment occurs first when the flower buds begin to appear, and that if treatment is given later than this, the degree of damage will increase with the age of the plant. Under commercial conditions, in which most growth is made in August-December, the plants should be treated not later than late August or early September, when the early flower buds may be expected. Complete kill of the mite at this time, with care to prevent reinfestation, will probably permit the successful production of cyclamen plants.

UNDERHILL (G. W.). **Two Pests of Legumes : *Alydus eurinus* Say, and *A. pilosulus* Herrich-Schaeffer.**—*J. econ. Ent.* **36** no. 2 pp. 289-294, 5 figs., 5 refs. Menasha, Wis., 1943.

The author describes all stages of *Alydus eurinus*, Say, and *A. pilosulus*, H.-S., which have been taken in Virginia from the tidewater section to the mountainous region in the west, and gives data on their life-history. The nymphs and adults feed on the nectar glands, stems and seed pods of almost all wild and cultivated leguminous plants, lima beans, soy beans and cowpeas being the crops most seriously injured. The germination of the injured seeds is reduced, and the vigour of the plants developing from them is lowered. These Coreids have two complete generations a year, and probably a partial third one in eastern Virginia; the winter is passed in the egg stage, and the

complete life-cycle lasts about 10 weeks in summer. Adults of the overwintering generation of *A. eurinus*, which is usually the commoner species, are in the field from late April or May until about the middle of September, and those of the first generation from the beginning of August until December. Adult males and females lived for averages of 42 and 40.1 days, respectively, in the laboratory. The preoviposition period averaged 20.9 days, the oviposition period 7 and 15 days for females collected in the field and reared in the laboratory, respectively, and the number of eggs per female 27.4. Oviposition was greatest at temperatures of 75–80°F. or more, and the peak of oviposition by the overwintering and first generations occurred in June and in late July and August, respectively. Eggs laid between 7th May and 17th August hatched in 8–18 days; the nymphs passed through their five instars in 41–50 days. Males and females of *A. pilosulus* survived for averages of 43.6 and 42 days in the laboratory. The preoviposition period averaged about 18 days and the oviposition period about six and three weeks for females collected in the field and reared in the insectary, respectively. The average number of eggs per female in 1929 was 38.3, and the average incubation period for eggs deposited in July–September 1930 ranged from 9.6 to 23.7 days; the nymphs passed through the five instars in 35.8–40.7 days.

No parasites were observed, but ants readily attacked the eggs and are believed to destroy large numbers.

BRANNON (L. W.) & REED (W. D.). **Survey of Tobacco Carriers for Stored-Tobacco Insects.**—*J. econ. Ent.* **36** no. 2 pp. 295–299, 4 figs. Menasha, Wis., 1943.

The following is substantially the authors' summary. From 1st October to 31st December 1939, a survey was made at two ports in Virginia to determine the importance of ships, railway cars and motor trucks carrying tobacco in disseminating such pests as *Ephestia elutella*, Hb., and *Lasioderma serricornis*, F. During the survey, 69 ships, 146 railway cars and 59 motor trucks were inspected. Although no tobacco insects were found in any of the ships taking domestic tobacco to foreign countries, remnants of many suitable food materials other than tobacco were found either in holds in which tobacco was placed or in adjoining holds. Tobacco from several sources was often placed in the same hold, thereby subjecting fumigated tobacco to possible infestation in transit. Practically all the foreign-grown tobacco brought in during the period of survey was infested by *Ephestia* and *Lasioderma*. Domestic tobacco for export was sometimes placed in ship holds from which infested imported tobacco had just been removed, and ships bringing in imported tobacco were often docked close to ships loading domestic tobacco for export. Imported tobacco frequently remained on piers for 2–5 days prior to transport by rail. Although *L. serricornis* was not found in any of the railway cars inspected, nine contained living adults of *E. elutella* on arrival at port terminals. Apparently the moths had flown into the cars at the time of loading, showing that this type of carrier may be an important factor in the development of new infestations in uninfested storage warehouses or of causing reinfestation of fumigated warehouses. Motor trucks appeared to be of little importance in disseminating insect pests of stored tobacco.

BRUBAKER (R. W.) & REED (W. D.). **Fumigation of Tobacco at reduced Pressures.**—*J. econ. Ent.* **36** no. 2 pp. 300–303, 2 figs., 6 refs. Menasha, Wis., 1943.

The following is based on the authors' summary. Experimental fumigations of imported cigarette tobacco were made at reduced pressure to obtain data on the most effective dosages of hydrocyanic acid, methyl bromide and

1,1-dichloro-1-nitroethane for the control of insect pests and to compare their relative toxicity at reduced pressures. The test insects, well-grown larvae of *Lasioderma serricorne*, F., were placed at various depths down to 9 ins. in the tobacco by means of steel test spikes. The bales were fumigated at about 70–80°F. in a small vacuum chamber and all exposures were for three hours under an absolute pressure of 1–1.5 ins. mercury, followed by a post-fumigation period of 72 hours at normal pressure in the laboratory. The insects were kept for seven days after removal from the tobacco, and daily observations on survival showed that the percentage mortalities at all depths given by dosages of 1, 2, 3 and 4 lb. per 1,000 cu. ft. averaged 86.9, 100, 100 and 100, respectively, for methyl bromide, 97.2, 99.8, 99.87 and 100 for HCN and 65.9, 90.73, 99 and 99.4 for 1, 1-dichloro-1-nitroethane. The fumigants had no deleterious effect on the tobacco.

DITMAN (L. P.), VOGHT (G. B.) & SMITH (D. R.). **Undercooling and Freezing of Insects.**—*J. econ. Ent.* **36** no. 2 pp. 304–311, 4 figs., 7 refs. Menasha, Wis., 1943.

The following is substantially the authors' summary. A comparison of types of apparatus for determining the undercooling and freezing points of insects as described by Robinson [*R.A.E.*, A **17** 310] and Salt [**25** 723] and by Siegler as modified by Ditman, Weiland & Guill [**29** 123] was made with insects of six species at refrigeration temperatures ranging from –8 to –70°C. [17.6 to –94°F.]. At a minimum low temperature, all types of apparatus gave fairly accurate results, but as refrigeration temperatures were reduced, the three types of holders gave varying results because of differences in heat conductivity, specific heat and density and because of the situation of the thermocouple with regard to the source of refrigeration. Undercooling points observed with Robinson's apparatus were higher as refrigeration temperatures were lowered; with the holder of cork and wool described by Ditman, Weiland & Guill, observed undercooling points varied directly with refrigeration temperatures; with the rubber holder of Salt, observed undercooling points were not greatly influenced by refrigerator temperatures. The extent of the rebound is also influenced by the type of holder; it was greatest with the cork and wool holder and least with the rubber holder. Accurate observed undercooling and freezing points cannot be determined in the same operation by the use of present methods.

Undercooling appears to be a physical condition brought about by the reduction and distribution of water in the insect, in which it is suggested that materials colloidal in nature play a part. Both undercooling and freezing points are influenced by reduction of body water. Information on the extent of undercooling is useful in interpreting and predicting winter survival of insects in the field, but must be applied with great care. For example, it is pointed out that laboratory observations on the undercooling point of overwintering larvae of the codling moth [*Cydia pomonella*, L.] closely approximate conditions in the field, whereas those for pupae of the corn earworm [*Heliothis armigera*, Hb.] under dry laboratory conditions indicate a greater resistance to cold than actually occurs in the field in moist soil.

HARTZELL (A.). **Pyrethrum Culture in Dalmatia with some Applications to the Americas.**—*J. econ. Ent.* **36** no. 2 pp. 320–325, 4 figs., 12 refs. Menasha, Wis., 1943.

The author describes briefly the whole process of pyrethrum culture, including seed harvest, sowing, transplanting and harvesting, based on the literature and observations made several years ago in Dalmatia. One of the chief reasons why pyrethrum has not been grown commercially in the United States is the large amount of hand labour hitherto required, but with the development

of machine methods of harvesting, it will probably become an important crop in the Americas. The importance of elevation in the production of pyrethrum in the United States and South America is discussed.

FELT (E. P.) & BROMLEY (S. W.). **Shade Tree Insects and Protective Concealment in Military Areas.**—*J. econ. Ent.* **36** no. 2 pp. 326–327. Menasha, Wis., 1943.

Notes are given on the defoliating insects and borers, particularly Scolytids, that are likely to cause injury to shelter trees retained or planted for protective concealment in military areas in the United States, the species dealt with being chiefly those that occur in the north-eastern part of the country. Instances are cited of outbreaks of Scolytids that resulted from damage to trees by a hurricane in 1938, and it is pointed out that the trees of most value for concealment in military areas are the ones most likely to be affected adversely by construction or development work, and therefore most likely to be killed by borers or to suffer from the effects of defoliation.

EIDE (P. M.). **Host Plants of the Banded Greenhouse Thrips.**—*J. econ. Ent.* **36** no. 2 pp. 327–328. Menasha, Wis., 1943.

A table is given showing 51 species of plants that were infested by *Hercinothrips femoralis*, Reut., in a greenhouse at Sumner, Washington, over several years, with notes on the degree of infestation, and a list of 16 that were not affected. Plants of the family Amaryllidaceae were apparently preferred, although *Narcissus* sp. and *Zephyranthes candida* were not particularly favoured, and the thrips was never observed on *Vallota speciosa*. Records made in 1938 showed that males represented less than 1 per cent. of the population until August, after which they increased to a maximum of 14.5 per cent. in early October and then decreased rapidly.

DONOHUE (H. C.). **A Comparison of Methods for the Fumigation of empty Banana Refrigerator Cars with liquid Hydrocyanic Acid.**—*J. econ. Ent.* **36** no. 2 pp. 328–329. Menasha, Wis., 1943.

In view of the cumbersome equipment required for fumigating empty railway refrigerator cars that have been used for the transport of bananas with 6 oz. liquid hydrocyanic acid per car in trays 2 sq. ft. in area suspended below the hatch cover for the control of *Popillia japonica*, Newm., in compliance with quarantine regulations [*cf.* *R.A.E.*, A **22** 571; **28** 90], attempts were made to improve on this method of application. The fumigant was applied at the rate of 6 oz. per car in two pans each 50 sq. in. in area, one in each bunker, or was splashed against one bunker end wall or in equal quantities against opposite end walls at the rate of 6 or 8 oz. per car, and the period of exposure was 2 hours. The pan method gave almost complete mortality (99.55–99.83 per cent.) of freshly collected beetles placed in well ventilated cages at various standard positions in the cars, although the temperature was below 75°F. in two of four tests. The 6-oz. dosage was less reliable when splashed against one wall (89.99–100 per cent.) or two walls (96.41–100 per cent.), but the 8 oz. dosage, which gave 99.91–100 per cent. mortality when splashed against one wall and 99.85–100 per cent. when splashed against two, appeared to be effective, and both this and the pan method used are considered suitable for quarantine treatment, since, in commercial practice, where few beetles per car are found, it is extremely improbable that any beetle capable of starting a new infestation would survive and escape from a car treated by either method.

PEPPER (B. B.). **The Relationship between Cropping Practices and Injury by *Heliothis armigera* with especial Reference to Lima Beans and Tomatoes.**—*J. econ. Ent.* **36** no. 2 pp. 329–330. Menasha, Wis., 1943.

A change in the feeding habits of *Heliothis armigera*, Hb., in New Jersey has been caused by a marked increase in the production of lima beans for canning and quick freezing. Before 1935, ripening tomatos grown for canning in southern New Jersey were heavily infested by *H. armigera*, which was fairly evenly distributed over the tomatos in the State. At this time, the acreage of lima beans began to increase rapidly, and soon after, injury to tomatos within 5 miles of lima-bean fields began to cease and the number of adults in the bean fields to increase; tomato fields 10–15 miles away from lima beans continued to be infested. The moths may be found on the lima beans within 5 days of the beginning of flowering and they fly freely and feed during the day, even in bright sunlight, possibly owing to nectar secretion in the blossoms. Infestation in the ears of sweet and field maize was much less in the lima-bean area than at some distance, but it is not known whether the attraction of the lima beans is entirely responsible for this difference. After the lima beans had been harvested in late summer and early autumn, spinach and broccoli were often grown on the same fields or other fields in the same area, but the production of broccoli has been discontinued owing to infestation by *H. armigera*, which feeds on the leaves; rather serious infestations have developed on spinach in some areas, though the moth is seldom noted on this crop in the northern sections of the State.

In central New Jersey, where the production of lima beans began to increase in 1938, the trends in infestation on tomatos and lima beans have been almost identical with those reported for the southern counties. No infestations have been observed on tomatos grown for canning in areas in which lima beans have become abundant, but 50 per cent. of the crop of the latter in late maturing fields was destroyed in 1942.

BARBER (G. W.). **Styrene Dibromide as a Substitute for Pyrethrum in Oil for Corn Earworm Control.**—*J. econ. Ent.* **36** no. 2 pp. 330–332. Menasha, Wis., 1943.

The following is substantially the author's summary. Field tests in New Jersey in 1941 and in Texas in 1942 showed white oil containing 0.75 gm. or more styrene dibromide (α - β -dibromoethylbenzene) per 100 cc., when injected into sweet maize ears, gave protection from larvae of *Heliothis armigera*, Hb., that compared favourably with that resulting from oil containing 0.2 per cent. pyrethrins, 2 per cent. dichloroethyl ether or 2 per cent. ethylene dichloride. Styrene dibromide is slowly soluble in oil and imparts no colour to it, and the solution does not injure or change the appearance of the ears. Persons eating treated ears failed to detect any residue, and rabbits fed on treated ears were unaffected. Toxicity tests on the larvae showed that styrene dibromide in oil was a contact insecticide, but that larvae often lived for several days after treatment, although they did not usually feed during this time.

KNOWLTON (G. F.) & WOOD (S. L.). **Utah Bird Predators of the False Chinch Bug.**—*J. econ. Ent.* **36** no. 2 pp. 332–333. Menasha, Wis., 1943.

In the course of an examination of the stomach contents of insectivorous birds collected throughout Utah in 1934–42, 3,565 adults and 1,032 nymphs of *Nysius ericae*, Schill., which frequently damages various garden and forage crops, were recorded from 420 birds of 46 species. A list shows the number of each species examined, the number containing *N. ericae* and the number of bugs found.

WENE (G.). *Sagaritis provancheri* (D. T.), an important Parasite of the Tobacco Budworm.—*J. econ. Ent.* **36** no. 2 pp. 333-334. Menasha, Wis., 1943.

Larvae of *Heliothis virescens*, F., usually appear on tobacco in Virginia about 1st June and cause considerable damage by feeding on the young leaves of the bud, though most of them are later destroyed in the process of topping the plants. In June 1942, first- and second-instar larvae of this Noctuid were found to be parasitised by the Ichneumonid, *Sagaritis provancheri*, D. T., which apparently reduced the injury considerably. The parasite usually kills the host during its second or third instar. Only one can develop in each host, and it leaves the latter to pupate and spins its cocoon, usually near the apex of a leaf near the bud or on a seed pod, within a few hours. The pupal stage of two individuals lasted five days. A few hyperparasites, *Spilochalcis side*, Wlk., were reared from cocoons collected at Chatham. The percentage parasitism of *H. armigera* was over 50 by 6th July in all but one of eleven fields in Pittsylvania County, and in a plant bed at Chatham it increased from 14.3 on 14th June to 85.7 on 30th June.

PLETSCH (D. J.). The Say Stinkbug on Potatoes in Montana.—*J. econ. Ent.* **36** no. 2 pp. 334-335, 4 refs. Menasha, Wis., 1943.

In 1939 a farmer in Montana reported a severe infestation of potato by a Pentatomid provisionally identified as *Chlorochroa sayi*, Stål, but the bugs had migrated to wheat by the time the farm was inspected. In 1940, bugs collected from wheat fields were caged with potato plants from 1st August until 17th September, when plants infested with ten individuals were found to be uninjured, those with 25 and 50 showed slight injury and those with 100 extensive injury. All the damage was local, unlike that reported from Colorado [*R.A.E.*, A **28** 147], and consisted of complete wilting of some leaves or tips of the plants. Tuber formation of all plants was normal. On 20th June 1941, the bugs were numerous in three potato plantings in a different county in Montana, where as many as ten were observed on single plants, and the same type of damage was caused. Further injury was not noticeable, but the bugs were occasionally observed in subsequent visits from 29th June until 6th September, and clusters of eggs were found on the foliage of potato and *Solanum nigrum*. It is considered unlikely that *C. sayi* will become a serious pest of potato in Montana.

SCOTT (L. B.) & MILAM (J.). Cryolite Injury to Tobacco Seedlings.—*J. econ. Ent.* **36** no. 2 p. 335, 1 ref. Menasha, Wis., 1943.

In experiments in Tennessee in 1938, dipping tobacco seedlings in a mixture of 3 oz. cryolite (85 per cent. sodium fluoaluminate) and 1 U.S. gal. water, or the roots and stems only in one of 4 oz. and 1 U.S. gal., gave promising control of *Crambus caliginosellus*, Clem., without damaging the plants [*cf. R.A.E.*, A **27** 652]. In subsequent tests, made under different soil and weather conditions, severe plant injury was caused by identical treatments and similar ones with mixtures containing as little as 1 oz. cryolite per U.S. gal.

WOODWORTH (C. E.). Tests using 1,1-dichloro-1-nitroethane against Wireworms.—*J. econ. Ent.* **36** no. 2 pp. 335-336, 2 refs. Menasha, Wis., 1943.

In 1942, experiments were carried out with 1,1-dichloro-1-nitroethane as a soil fumigant against wireworms. In preliminary laboratory tests, 1-5 mg. in a litre of moist air gave complete mortality of larvae, 2-3 years old, of *Pheletes (Limonijs) californicus*, Mannh., in 5 hours, and approximately 10 mg. gave complete kill in 500 gm. moist soil in a 1-litre flask in 5 hours. Field tests with caged wireworms in holes 6, 9, 12 and 15 ins. from the points of injection

showed that the chemical readily permeated Walla Walla silt loam soil, 0.5 oz. in holes 1 inch deep and 1 inch in diameter killing all the wireworms in a 6-inch circle to a depth of at least 12 ins., and practically all those in a 9-inch circle to a depth of 9 ins.; 1 oz. killed slightly more, but the mortality was not proportional to the amount of chemical used. All larvae in soil saturated and submerged to a depth of half an inch by a 0.01 per cent. aqueous solution for one day in the laboratory were killed, but a 0.001 per cent. solution was no more effective than water. In repellency tests in which 25 larvae were placed at each of four depths (1.5, 4.5, 7.5 and 10.5 ins.) in containers containing 1 cu. ft. moist soil to which the nitroethane was added in a hole half an inch deep and one inch in diameter in the centre of the surface, 13 of the hundred larvae were found in the top 6 ins., 23 6-9 ins. deep and 64 9-12 ins. deep, all being dead, after treatment with 5 cc. of the chemical, 87-88 were 9-12 ins. deep and all were dead when 7.5 or 10 cc. was used, and 22-28 were found in each 3-inch layer, all but one being alive, in untreated soil, indicating that the material is repellent and does not kill rapidly enough to prevent the larvae from trying to escape. Germination tests showed that a 0.1 per cent. solution had no detrimental effect on cucumbers or melons, but slightly retarded onions, peas and maize; a 0.01 per cent. solution did not interfere with the germination of any of these seeds. In field tests in which the chemical was applied to the furrow half an inch below the seeds, it protected peas and cucumbers from wireworm damage but gave less protection to the other crops tested. The most effective quantity was 2 cc. per foot of row; 5 cc. caused severe injury. Little advantage was gained when the nitroethane was applied to protect growing plants and damage was severe when it touched the stem or foliage.

STEINER (L. F.), ARNOLD (C. H.) & FAHEY (J. E.). **Tests of Mississippi Bentonites in tank-mix Nicotine Bentonite Sprays for Control of the Codling Moth.**—*J. econ. Ent.* **36** no. 2 pp. 338-339, 4 refs. Menasha, Wis., 1943.

One of the most serious objections to the tank-mix spray of nicotine bentonite and soy-bean oil, which has given very effective control of *Cydia (Carpocapsa) pomonella*, L., in the Middle West [*cf. R.A.E.*, A **26** 732], has been the heavy bentonite residue on the apples at harvest, which is sometimes difficult to remove, but investigations have shown that mixtures prepared with certain untreated Mississippi bentonites, instead of the Wyoming types formerly used, are highly effective and do not leave objectionable residues. They swell to not more than three times their original volume in water, and approximately 8 lb. corresponds to 5 lb. of a Wyoming bentonite in fixing 90 per cent. of the nicotine from a solution of 1 U.S. pint nicotine sulphate (40 per cent.) in 100 U.S. gals. water.

In preliminary small-scale experiments in Indiana in 1942, details of which are shown in tables, lead arsenate was applied to four cover sprays against the first generation and three against the second and third, and mixtures of nicotine sulphate, bentonite and mineral or vegetable oil in four cover sprays against the first generation and four against the second and third. All sprays gave approximately equal percentages of uninjured apples, though Mississippi bentonite produced deposits that were lighter and less resistant to weathering than did Wyoming bentonite. No foliage injury occurred in any of the nicotine plots, but lead arsenate caused serious injury. All visible bentonite residues were readily removed by brushing from fruit treated with Wyoming bentonite against the first generation and with Mississippi bentonite against the second and third or with Mississippi bentonite in all sprays, but an objectionable amount remained after brushing in the stem and calyx ends of fruit treated with Wyoming bentonite throughout the season. Fruit sprayed with nicotine bentonite was superior to that treated with lead arsenate in both finish and

colour, and the control of such pests as Jassids, leaf miners and the woolly apple aphid [*Eriosoma lanigerum*, Hsm.] was equally good in all nicotine plots. In supplementary tests a bentonite from Georgia was less effective in fixing nicotine from water solutions than Mississippi bentonites, but several bentonites from other regions have approximately the same physical and chemical properties as the latter, and may prove suitable with proper adjustments in the formulae.

LINSLEY (E. G.). **Attraction of Melanophila Beetles by Fire and Smoke.**—*J. econ. Ent.* **36** no. 2 pp. 341–342, 1 fig., 14 refs. Menasha, Wis., 1943.

From complaints received in California from sawmill operators, fire fighters, smelter plant workers and spectators at football matches, when many thousands of them were smoking cigarettes, regarding annoyance caused by Buprestids of the genus *Melanophila*, which appear to be greatly stimulated by heat and attracted by smoke, although under ordinary conditions they are rarely seen in nature, and from a review of the literature, the author concludes that these beetles are attracted over long distances by smoke from a variety of burning materials, including wood, oil, mill refuse, smelter products and possibly tobacco. In nature, this attraction leads them to forest fires, where they normally oviposit in scorched coniferous wood. They are also stimulated by heat, and in the vicinity of its source, they fly rapidly and run about over hot surfaces. Light probably has little, if any, share in their attraction to fires.

WALKER (H. G.) & ANDERSON (L. D.). **Control of Aphids and Diamond-back Moth Larvae on Collards with Rotenone-Nicotine Dusts.**—*J. econ. Ent.* **36** no. 2 pp. 343–344, 3 refs. Menasha, Wis., 1943.

Since nicotine dust controls Aphids on crucifers [*cf. R.A.E.*, A **28** 172] and repeated applications of derris and cubé dusts control larvae of *Plutella maculipennis*, Curt. [*cf. 25* 690], dusts of nicotine, derris, derris and nicotine and derris and pyrethrum were compared for the control of a heavy infestation of *Brevicoryne brassicae*, L., *Myzus persicae*, Sulz., and *P. maculipennis* that developed on collard and kale in Virginia in the autumn of 1941. The nicotine dusts used were Black Leaf 155 (14 per cent. nicotine fixed on a bentonite carrier) and Black Leaf 10 (finely ground tobacco stems impregnated with 10 per cent. free nicotine). The dusts were mixed on 10th November and applied to collards on 11th and 18th November at the rate of 40–45 lb. per acre from a duster equipped with a cloth trailer about 30 ft. long. Counts made on 17th and 22nd November showed that dusts of Black Leaf 155 in hydrated lime (2 or 3 per cent. nicotine) were more effective than one of derris powder in pyrophyllite (0.75 per cent. rotenone) against *M. persicae*, but less effective against *Plutella*. Dusts of Black Leaf 155 or Black Leaf 10 and derris in pyrophyllite and of Black Leaf 155 and derris in hydrated lime (2 or 3 per cent. nicotine and 0.75 per cent. rotenone) tended to be more effective than the Black Leaf 155 and hydrated lime in controlling the Aphid and more effective than the derris and pyrophyllite against the caterpillars. There was a tendency for hydrated lime to be a better diluent than pyrophyllite for the dust of derris and Black Leaf 155. A dust of derris powder, pyrethrum and talc (1 per cent. rotenone and 0.1 per cent. pyrethrins) gave good control of *Plutella*, but was unsatisfactory against the Aphid. The combined dusts of nicotine and derris also gave very satisfactory results when used commercially for the control of these insects on collard and kale. Counts of *B. brassicae* were not made, but general observations indicated that its reaction to the dusts were similar to those of *M. persicae*.

NEWCOMER (E. J.). **Apparent Control of the Pacific Mite with Xanthone.**—*J. econ. Ent.* **36** no. 2 pp. 344-345. Menasha, Wis., 1943.

In three apple orchards used for experiments against the codling moth [*Cydia pomonella*, L.] in Washington in 1941, there was practically no infestation by *Tetranychus pacificus*, McG., in mid-August on trees treated with five or six cover sprays of 2 lb. xanthone, 1 U.S. pint stove oil and 4 oz. colloidal spreader per 100 U.S. gals., but very definite infestation on those treated with 3 lb. lead arsenate, 1 U.S. quart mineral oil and 2.67 oz. spreader, or with 2 lb. phenothiazine, 1 U.S. quart stove oil and 1.5 lb. soap, per 100 U.S. gals. Since the quantity of oil applied was twice as great with the last two sprays, this cannot have been the cause of the control obtained with the xanthone spray. In 1942, when infestation by the mite was much heavier, that on trees treated with 2 lb. xanthone and 1 U.S. quart of an emulsion of casein and stove oil (75 per cent. oil) per 100 U.S. gals. from the third cover spray was only half as heavy in late July as that on trees receiving 1 lb. phenothiazine with 1 U.S. quart of the same emulsion or the lead arsenate spray used in the previous year and had increased less by 14th August, after another cover spray, although the quantity of oil in the lead-arsenate and phenothiazine sprays had been doubled.

These records indicate that xanthone hinders the development of *T. pacificus*, but it is not certain whether it would afford practical control under various conditions.

NETTLES (W. C.). **Plant Stimulation aids in Control of *Pissodes nemorensis* on *Cedrus deodara*.**—*J. econ. Ent.* **36** no. 2 p. 345. Menasha, Wis., 1943.

Pissodes nemorensis, Germ., which is present in most plantations of *Cedrus deodara* in South Carolina, causes dying of the branches and may kill entire trees, but observations over a number of years indicate that damage can largely be prevented by stimulating tree growth by the application of commercial fertilisers or of compost and by watering when necessary during dry periods. The weevil has also been reported as feeding on pines.

SCHWARDT (H. H.) & WHITCOMB (W. H.). **Life History of the European Chafer *Amphimallon majalis* (Razoum.).**—*J. econ. Ent.* **36** no. 2 pp. 345-346, 1 ref. Menasha, Wis., 1943.

Damage by *Amphimallon majalis*, Razoum., which is now known to infest an area of 140 square miles in New York, but has not been recorded from any other locality in the western hemisphere, has been largely urban and chiefly confined to turf. Details are given of the life-history of this Melolonthid [cf. *R.A.E.*, A **31** 301]; though the larvae were found feeding on the roots of various plants, they showed a marked preference for grasses and a less one for chrysanthemums and strawberries. In 1942, the eggs were deposited in the soil at a depth of 2-6 ins. and pupation took place 4-8 ins. below the surface between 20th May and 4th June. The egg stage, three larval instars and pupal period lasted 16-19 days, 35 days, 16 days, 8 months, and 14 days, respectively, under field conditions.

YUST (H. R.) & FULTON (R. A.). **An Exudation associated with the Feeding Location of the California Red Scale.**—*J. econ. Ent.* **36** no. 2 pp. 346-347, 1 fig., 1 ref. Menasha, Wis., 1943.

The authors describe investigations on the chemical and physical properties of an exudation that frequently appears at the feeding site of *Aonidiella aurantii*, Mask., on fruits of lemon squash and citron melon after the scale has been removed. It proved to be almost pure sucrose, and comes up through the

broken-off rostralis in the fruit. Occasionally droplets of this fluid, which is undoubtedly the food of the scale, are produced at the feeding site of living scales and may partially or completely cover them; when this happens, a fungus, which grows readily on the exudation under humid conditions, appears to be growing on the body of the scale itself.

HANSEN (J. W.). **Surface Area of Persian Walnuts.**—*J. econ. Ent.* **36** no. 2 p. 347. Menasha, Wis., 1943.

The author describes a rapid method of calculating the surface area of immature and mature Persian walnuts [*Juglans regia*] from the volume, which was determined by immersion in a graduated cylinder, for use in analyses of the initial deposit and weathering of insecticides.

LINSLEY (E. G.). **Delayed Emergence of *Buprestis aurulenta* from Structural Timbers.**—*J. econ. Ent.* **36** no. 2 pp. 348-349, 11 refs. Menasha, Wis., 1943.

Buprestis aurulenta, L., is fairly common in the coniferous forests of western North America, where it breeds in lightning-struck, fire-scorched or dying trees and in recently felled logs and stumps. It appears to prefer *Pseudotsuga taxifolia*, but attacks practically all the species of pine occurring within its range and occasionally breeds in spruce (*Picea*). It has also been recorded from *Abies grandis* and western red cedar [*Juniperus occidentalis*], but the author considers the latter food-plant exceptional if the record is authentic. The larvae usually complete their development in 1-3 years, readily mine heartwood as well as sapwood and pupate in late summer or autumn. Transformation takes place in autumn, and the adult overwinters in the pupal cell and normally flies from April to September. On several occasions records have been made of the emergence of this Buprestid from structural wood many years after it has been prepared and used [cf. *R.A.E.*, **A 19** 438]; and from a review of the literature and observations made since 1937, the author concludes that the beetle frequently emerges from prepared timbers after they are in place in a structure; that there is some evidence to indicate that it may oviposit on green timber and exposed timbers in the open; that there is no good evidence to indicate that it ever flies into a building and oviposits on finished wood in place in a structure; and that the emergence of one individual in Germany from furniture made 13 years before, partly from wood imported from America [**24** 656] proves beyond reasonable doubt that the species is capable of a prolonged existence in cured wood.

BIGGER (J. H.) & MARCH (R. B.). **Rearing Southern Corn Rootworms on Seedling Corn Plants.**—*J. econ. Ent.* **36** no. 2 pp. 349-350, 1 fig., 4 refs. Menasha, Wis., 1943.

The authors describe a successful technique that was developed for rearing *Diabrotica duodecimpunctata*, F., on individual maize seedlings growing on agar-agar in petri dishes in order to determine whether feeding on different inbred lines of maize had any effect on the development of the larvae.

DOBROSKY (I. D.). **Orchard Dusting Experiments with natural Cryolite for Codling Moth.**—*J. econ. Ent.* **36** no. 2 pp. 350-351, 2 refs. Menasha, Wis., 1943.

In view of the labour shortage, the value of dusts instead of sprays was tested on 15-year-old apple trees in New York in 1942. Delayed-dormant and pre-pink sprays of lead arsenate and lime-sulphur were applied as usual, after which

dusts of natural cryolite or lead arsenate in sulphur (20 : 80) were applied three times in May against apple scab, of which they gave very good control, and three times in June and twice in July against the first and second generations of the codling moth [*Cydia pomonella*, L.]. They were applied at the rate of $1\frac{1}{2}$ lb. dust per tree, usually between 5 and 9 p.m., when there was a fine coating of dew on the leaves and no wind. Because dusting could be carried out in a rainy period and as many trees treated in three hours as would take three days to spray, it was possible to time and execute the applications very promptly and speedily. Examination of samples of 100 apples picked at random from the bottom and top of each of 10 trees in each block showed that cryolite gave much better control of *C. pomonella* than lead arsenate, the average numbers of injuries being 6.7 and 14.6 per sample, respectively, and it caused no injury to fruit or foliage. The control obtained is considered to be satisfactory from a commercial standpoint.

The poorer results with lead arsenate may have been partly due to the fact that it was applied to trees that were nearer to the packing shed and other farm buildings.

HANSBERRY (R.) & LEE (C.). **The Yam Bean, *Pachyrhizus erosus* Urban, as a possible Insecticide.**—*J. econ. Ent.* **36** no. 2 pp. 351–352, 3 refs. Menasha, Wis., 1943.

The seeds of the yam bean, *Pachyrhizus erosus*, have been used as an insecticide and fish-poison in various tropical countries for many years, and since it is an annual crop that may be harvested 4–6 months after planting, investigations were carried out in the laboratory in the autumns of 1941 and 1942 with a sample of seeds collected in Kwangsi in autumn 1940. They were found to contain only a trace of rotenone by the Goodhue modification of the Gross and Smith colorimetric method [*cf. R.A.E.*, A **30** 418] and yielded 27.8 per cent. total extractives in alcohol, 22.8 per cent. in acetone, 18.6 per cent. in chloroform and in petroleum ether (boiling point 60–70°C.) and 19.4 per cent. in carbon tetrachloride. When mature apterous agamic females of *Aphis rumicis*, L., on flannel were sprayed with suspensions of the ground seeds and of cubé (4 per cent. rotenone) and transferred to unsprayed nasturtium leaves, concentrations of 1.5, 0.5, 0.1 and 0.01 gm. yam bean per 100 cc. water gave 99, 80, 24 and 13 per cent. mortality, as compared with 100, 97 and 38 per cent. from cubé used at the three lower rates. Yam bean dust as a stomach poison gave 100, 28 and 4 per cent. mortality, respectively of first-instar larvae of *Epilachna varivestis*, Muls., mature larvae of *Tortrix (Archips) cerasivorana*, Fitch, and mature larvae of *Alsophila pometaria*, Harr., when the insects were put on dusted foliage for 48 hours; cubé dust also gave 4 per cent. mortality of the last species. When emulsified in water at a concentration equivalent to 1 gm. dry powder per 100 cc., extracts of yam bean in carbon tetrachloride, alcohol, chloroform, petroleum ether and acetone gave 90, 97, 92, 100 and 100 per cent. mortality after 96 hours of larvae of *Bombyx mori*, L., that were put on leaves that had been dipped in the emulsions and allowed to dry; the percentages for corresponding extracts of cubé in the first four solvents were 76, 98, 74 and 52. Similar treatment with extracts of yam bean in alcohol and petroleum ether and of cubé in alcohol resulted in 20, 24 and 100 per cent. mortality of *Pieris rapae*, L. Sprays containing 1 gm. per 100 cc. of ground yam bean, 4 per cent. cubé root and 3 lb. per 100 U.S. gals. lead arsenate, respectively, applied to apples which were allowed to dry and then infested with eggs of the codling moth [*Cydia pomonella*, L.] permitted 40, 6 and 40 per cent. of the larvae to enter the fruit.

The authors state in a foot-note that 12 samples from the western hemisphere gave consistently high kills of larvae of *E. varivestis* in laboratory tests with

20 per cent. of the ground seed in talc. Total extracts averaged about 28 per cent., approximately 90 per cent. of which was oil and the remainder resinous; when the fractions were tested in sprays against Aphids, the resin fraction was found to be the more toxic.

YUST (H. R.), NELSON (H. D.) & BUSBEY (R. L.). **Influence of Inbreeding on the Susceptibility of the California Red Scale to HCN.**—*J. econ. Ent.* **36** no. 2 pp. 352–353, 1 ref. Menasha, Wis., 1943.

To determine whether continued inbreeding of *Aonidiella aurantii*, Mask., such as occurs in a segregated stock in the laboratory, decreases the vitality of the insects and so increases their susceptibility to hydrocyanic acid gas, a stock of resistant scales was divided into two groups in 1937 and reared in isolated compartments under similar conditions until 1941, when they had passed through 18 generations. Males and females of the two groups were then crossed to form a third one. The same procedure was carried out with non-resistant scales. Lemon fruits infested with insects of the first generation of the mixed groups and of the nineteenth generation of the original groups were kept under constant conditions and fumigated with suitable dosages of HCN when the scales were in the second moult or mature females. The mortalities of the three groups of the same strain and stage were about the same in all cases, indicating that inbreeding had not influenced susceptibility.

KNOWLTON (G. F.). **Three new Pests invade Utah.**—*J. econ. Ent.* **36** no. 2 p. 353. Menasha, Wis., 1943.

The three insects recorded for the first time from Utah are *Supella supellectilium*, Serv., which was abundant in the kitchen of a house at Logan in January 1942; *Ptinus latro*, F., which had been reported from Canada but not the United States, and was found in bacon and prepared wheat cereal in a grocer's shop in Salt Lake City in May 1942; and a Bruchid, probably *Spermophagus (Zabrotes) subfasciatus*, Boh., in a shipment of lima-bean seed received in Salt Lake City from outside the State during the winter of 1941–42. The escape of the last species was prevented by prompt fumigation.

HATCH (M. H.). ***Ptinus tectus* damaging Furs in Alaska.**—*J. econ. Ent.* **36** no. 2 p. 353. Menasha, Wis., 1943.

Since 1941, *Ptinus tectus*, Boield., has caused considerable damage to raw furs and fur garments in a store at Platinum, Alaska (59°N.), in which it was the only insect observed, and similar injury has been reported from places 75 and 110 miles further north.

GORDON (W. M.). **Airplane Runways damaged by Ants.**—*J. econ. Ent.* **36** no. 2 p. 354. Menasha, Wis., 1943.

At Auxiliary Naval Air Stations near Corpus Christi, Texas, where *Pogonomyrmex barbatus* var. *molefaciens*, Buckley, is common, many runways have been built over the flat, bare nests of this ant, with the result that when aircraft taxi over them, the areas weakened by the underground tunnels and chambers give way, forming depressions 2–4 ins. deep and 18–24 ins. in diameter. Control measures consisted of making a hole through the crust into the galleries of the nest with a broomstick, pouring in 4–6 oz. carbon bisulphide or pumping in calcium cyanide and sealing the opening with a sod. A single application of either fumigant almost always gave complete control, and it was never necessary to make more than two applications.

FRIEND (R. B.). **Connecticut State Entomologist, Forty-first Report, 1941.**—*Bull. Conn. agric. Exp. Sta.* no. 461 pp. 463–548 [+3], 1 pl., 8 figs., refs. New Haven, Conn., 1942.

Work on insect pests and their abundance in Connecticut during the year ending 31st October 1941 is briefly reviewed by R. B. Friend (pp. 463–467). M. P. Zappe & L. A. Devaux (pp. 470–472), in a survey of the results of the inspection of nurseries, greenhouses and the premises of dealers in sand, soil and manure for the presence of *Popillia japonica*, Newm., state that 87 towns are now known to be infested [cf. *R.A.E.*, A 30 548]. J. T. Ashworth (pp. 475–478) reports on work in connection with the control of *Lymantria* (*Porthetria*) *dispar*, L. P. Garman, W. T. Brigham, J. C. Schread & G. R. Smith (pp. 487–490) give an account of work on biological control. Over 69,000 parasites of the larvae of *Cydia* (*Grapholitha*) *molesta*, Busck, were liberated in peach orchards during the year [cf. *loc. cit.*]. Percentage parasitism in July averaged 44.7 among the larvae and 62.7 among the eggs, as compared with 31.6 and 41.8 in 1940, and this increase, in conjunction with decreased host populations due to weather conditions, reduced the average percentage infestation of fruit at harvest from 19.4 in 1940 to 4.6 in 1941. Parasitism of both eggs and larvae has steadily increased since 1936, and the average percentage infestation has decreased since 1938. *Macrocentrus ancylivorus*, Rohw., was fairly abundant in districts where it was scarce or absent ten years ago. Approximately 1,000 lb. of dust containing spores of the organism (*Bacillus popilliae*) that causes milky disease of *Popillia japonica* was distributed over a total area of 751 acres. Diseased larvae were present in six of 25 experimental plots treated previously, as well as in a number of untreated areas, and 18 and 28 per cent. of the larvae were infected in two of the plots. A further liberation of 16 colonies of *Tiphia vernalis*, Rohw., was made against *P. japonica* [cf. *loc. cit.*]; both this species and *T. popilliavora*, Rohw., appear to be established. Approximately 1,800 individuals of *Allotropa* sp. No. 1 [cf. 31 464], 500 of *Leptomastix* sp., and 425 of *Clausenia purpurea*, Ishii, were liberated on 24th July and 1st August against Comstock's mealybug [*Pseudococcus comstocki*, Kuw.] on pear on a farm where the infestation was increasing rapidly. In October, *Allotropa* sp. was found to be present in considerable abundance, and one individual of *C. purpurea* was recovered.

Alternative winter hosts of parasites of *Cydia molesta* were investigated in 1938–41, and an account of the work, including annotated lists of the parasites reared from the fruit clusters of sumac (*Rhus typhina*, *R. copallina* and *R. glabra*), which are infested by several species of Lepidoptera and Hymenoptera, and from dwarf ragweed (*Ambrosia artemisiifolia*) collected from peach orchards, is given by Schread, Brigham & Smith (pp. 490–502). Of the 16 parasites reared from sumac, only one, *Ephialtes* (*Epiurus*) *indagatrix*, Cress., is of importance as a parasite of *C. molesta* in Connecticut, and only one individual was obtained. From ragweed, 47 parasites were reared, of which *Glypta rufiscutellaris*, Cress., *Macrocentrus delicatus*, Cress., *Cremastus forbesi*, Weed, *Pristomerus ocellatus*, Cushman, and *E. indagatrix* attack *Cydia molesta* in Connecticut. *G. rufiscutellaris* is the most important of these and was also the most abundant. Several species of *Microbracon* were reared from ragweed and one also from sumac, but members of this genus have not been recorded as attacking *C. molesta* in Connecticut. Species of *Eurytoma*, *Habrocytus*, *Tetrastichus* and *Eupelmus* were reared from ragweed, and of the first two genera and *Gelis* from sumac; these may all attack primary parasites of *C. molesta*. *Triaspis curculionis*, Fitch, which is an important parasite of *Conotrachelus nenuphar*, Hbst., was also reared from ragweed.

Continued work on the control of the apple maggot [*Rhagoletis pomonella*, Walsh] is reported by Garman (pp. 502–505). In an orchard in which 97 per cent. of apple fruits were injured in 1939 and in which some of the trees

received oil-impregnated rotenone dusts [30 549] in 1940 and all in 1941, 72 per cent. were injured in 1940 and only 30 per cent. in 1941, whereas infestation in surrounding untreated orchards reached 98–100 per cent. In another that was treated with a similar dust containing 0.5 per cent. rotenone in each of the three years preceding 1941, but not in that year, the percentage infestation increased from 7 in 1940 to 44 in 1941 in harvested fruits and from 26 to 46 in fallen fruits. The dust should be applied from both sides of the tree at intervals of 7–10 days during the peak of emergence; $1\frac{1}{2}$ –2 lb. is sufficient for a fairly large tree. It is not effective against the European red mite [*Paratetranychus pilosus*, C. & F.]. A finely-ground red slate dust containing 7.9 per cent. ferric oxide was as effective as red clay containing 6–8 per cent. ferric oxide in protecting rotenone in talc from the effects of exposure for 24 hours to ultra-violet rays [cf. 30 549]. When apples dusted with various materials were suspended in cages containing flies, a supply of water and a mixture of honey and yeast and left for 20 days, the percentages of mortality and (in brackets) the numbers of egg punctures per female were 100 (0) for a dust containing 0.5 per cent. rotenone, 91.5 (1.5) for phthalonitrile, 87.9 (0.01) for potassium antimony tartrate (tartar emetic), 83.5 (0) for Antimonelle [a preparation containing calcium antimony tartrate], 74.5 (0.19) for a commercial pyrethrum dust (Pyroicide 10) and 33.6 (15.3) in the control. Garman & J. F. Townsend (pp. 505–511) give an account of experiments on the control of *Paratetranychus pilosus*, which was not abundant in apple orchards until late in the season. A dust containing 1.7 per cent. of the sodium salt of dinitro-cyclohexylphenol gave good control in three orchards and was rather more effective than one containing 1 per cent. dinitro-ortho-cresol that was also used in two of them. A proprietary rotenone spray (Syntone) containing 2.8 per cent. rotenone and used at a concentration of 1 pint with 1 quart oil and a spreader per 100 gals. was about as effective as the former dust in one orchard and caused even greater reductions when used at half the concentration in another. The best of the materials tested appeared to be little superior to 1 per cent. summer oil, but the dinitro compounds are compatible with sulphur and rotenone compounds can be used as late as 1st September without spoiling the appearance of the fruit.

An account of studies in 1940 and 1941 on the control of apple pests by means of sprays containing materials other than sulphur is given by Garman (pp. 512–519). Equal insect control was given by sprays containing lead arsenate, lime and either fish oil or aluminium sulphate [cf. 31 483], but the latter caused less foliage drop; both were about as effective as lead arsenate with flotation sulphur or lime-sulphur against *C. nemophar*. Four applications of a spray containing 3 lb. lead arsenate, $\frac{1}{2}$ lb. soy-bean flour and 2 oz. manganese sulphate with the addition of 1 U.S. gal. lime-sulphur per 100 U.S. gals. in 1940 and $1\frac{1}{4}$ U.S. gals. in 1941 were almost as effective as four of a spray containing 8 lb. flotation sulphur and 3 lb. lead arsenate per 100 U.S. gals., but the higher concentration of lime-sulphur was followed by increased leaf-drop. *P. pilosus* became abundant in all plots that received sulphur in 1940, particularly in those that received flotation sulphur. Three applications of a spray of 3 lb. lead arsenate (doubled in the last two applications), 2 lb. aluminium acetoborate, 4 oz. benzoic acid and 2 U.S. quarts white mineral oil per 100 U.S. gals. [cf. 30 549] gave control about equal to that from four applications of 3 lb. lead arsenate and 8 oz. flotation sulphur per 100 U.S. gals.; significantly fewer fruits were infested by *R. pomonella*, and the condition of the foliage was better than that on trees that received sulphur. Although residues from this spray were slightly below the legal tolerance in 1941, which was a dry season, it should probably not be applied later than 7th June. The adhesive properties were good and the deposit remained on the foliage throughout the season in both years, except in a single test in which the spray was used in combination with nicotine bentonite and sulphur; the addition of fungicides caused injury

to the foliage or russetting of the fruit. The yield of trees of the variety Baldwin on which this spray was used in 1941 was considerably higher than that from trees sprayed with sulphur.

In a short report of work on the control of the European corn borer [*Pyrausta nubilalis*, Hb.], which is described at greater length elsewhere [31 508], N. Turner (pp. 520-521) states that in further experiments [cf. 30 129] in 1941, highly profitable yields were again obtained from early sweet maize that was dusted with dual-fixed nicotine at intervals of 5 days during June, although five applications instead of four were necessitated by heavy rain following the first.

In an account of investigations on the squash vine borer [*Melittia satyriniformis*, Hb.], R. L. Beard (pp. 521-523) states that since high yields were obtained in 1940 from early-planted squash, which was thought to have reached a size sufficient to enable it to resist injury at the time of insect attack, and indications were obtained that a 1 per cent. rotenone dust was equal in control to a spray of lead arsenate and fish oil, these treatments were further tested in 1941. Plants sown on 1st, 15th and 30th May were treated five times at weekly intervals starting on 2nd July. In the third week in August, infestation at the base of the vines, where attack is most frequent, was significantly lower on the treated than on the untreated plants and on plots dusted with 1 per cent. rotenone than on those treated with a proprietary dust of walnut-shell flour impregnated with rotenone. There was no significant difference between the 1 per cent. rotenone dust and the spray of lead arsenate and fish oil. No significant difference in infestation could be attributed to the date of planting, and the difference in yield was not significant between plots receiving different treatments or between plants sown on the first two dates; those sown on 30th May gave reduced yields, owing largely to the shorter growing season, but in part to insect injury.

Observations on Lamellicorn larvae, which were more injurious to turf in 1941 than for about forty years, are described by J. P. Johnson (pp. 523-530). The species concerned were *Popillia japonica*, *Anomala orientalis*, Waterh., *Aserica (Autoserica) castanea*, Arr., and *Cyclocephala borealis*, Arr., which have a one-year life-cycle, and *Lachnosterna (Phyllophaga) hirticula*, Knoch, L. (P.) *fusca*, Froel., and L. (P.) *gracilis*, Burm., which complete their development in 3 years. A few larvae of L. (P.) *tristis*, F., were also taken from turf in two localities. Flights of beetles were observed in two counties on warm nights between 25th and 29th May, and during them adults of L. *tristis*, L. (P.) *forsteri*, Burm., L. (P.) *crenulata*, Froel., L. (P.) *fraterna*, Harr., and L. (P.) *anxia*, Lec., were taken at lights. L. *tristis* defoliated raspberry and also attacked ash and blackberry, and L. *forsteri* also fed on the first two and on sweet cherry, walnut, wild cherry and cultivated rose. Larvae of *Anomala orientalis* severely damaged lawns and turf in a hayfield, and were recorded for the first time attacking potato tubers; of 182 otherwise marketable tubers, 60 were so damaged that they were unfit for sale. Larvae of the first three instars were present in the soil to a maximum depth of 12 ins. The range of both C. *borealis* and *Popillia japonica* continued to increase. Observations on the depth at which the larvae hibernate were made on 20th-24th October, when the downward movement had begun and soil temperatures were below 60°F. at a depth of 6 ins. and varied between 54 and 56°F. to depths of 22 ins.; most larvae of C. *borealis*, P. *japonica* and L. *gracilis* occurred in the upper 2 ins. of soil, those of A. *orientalis* were mostly at a depth of 4-8 ins., those of L. *fusca* at 9-15 ins., and those of L. *hirticula* at 9-18 ins. In October and November, larvae of L. *hirticula* and L. *fusca* were found at depths of down to 20-30 ins. The depth at which they hibernated appeared to depend on the depth of the subsoil, and only one larva was found in the sand that underlay it. Adults of *Dyscinetus morator*, F. (*trachypygus*, Burm.) were reared from larvae collected from rough turf; this Dynastid is not abundant in Connecticut, and

the larvae have not hitherto been recorded there. Larvae identified as *Aphonus castaneus*, Melsh., were observed on the surface of the turf of a golf course during rain on 8th July. Populations were estimated at 5 or more per sq. ft. over most of the course. Destruction of larvae of *Anomala orientalis*, *Aserica castanea*, *C. borealis*, *P. japonica* and *Lachnosterna* spp. by skunks appeared to have increased.

Friend & H. H. Chamberlin (pp. 530-537) describe investigations on injury by *Hylobius pales*, Hbst., to white pine [*Pinus strobus*] in New Hampshire and Connecticut. The adults, which are attracted by the odour of freshly-cut stumps, logs and slash, feed on the bark of young pines and on the twigs and small branches of older ones and the females deposit their eggs in small cavities gnawed in the roots of stumps, in which the larvae develop until the beginning of September, when they pupate in cells in the roots. The adults emerge at the beginning of October, feed until the end of the month, and hibernate in the soil until the end of April or May, when they feed until the middle of June and then migrate. Injury to young stands occurs during the spring, early summer and autumn in the first year after felling and in the spring of the second year. Severe injury is confined to trees less than 3 ft. high and over one year old. White pine is the preferred food-plant of the adults, but other trees are attacked; stumps of pitch pine [*P. rigida*] are very attractive to them, but hemlock [*Tsuga*] is less attractive than white pine. In order to avoid injury, it is usual to delay replanting until the third year after felling in plantations, and, where natural reproduction is to take place, to fell during the autumn or winter following a heavy seed-crop or to make a preliminary thinning to stimulate reproduction that will be available after clear cutting. Experiments in 1935-38 in a district in New Hampshire where frequent felling of small areas of white pine favours the maintenance of high populations of the weevil showed that such areas can be replanted with white pine in the second spring after felling with expectation of losses not exceeding 15 per cent. due to the weevil, since the highest mortality occurs before the adults appear in the second spring. Similar results were obtained in Connecticut in 1930-32. Injury in the second year after felling was greater on natural reproduction than on trees of the same size planted out in that year, since the former had also been exposed during the previous autumn. Many adults occurred on the damp zone at the base of the seedlings that grew up through damp moss and litter, but there were none at the base of planted seedlings, round which soil was packed closely. In addition to the size and density of the trees, the number of stumps present and the proximity of the trees to them, the proportion of young trees to be destroyed by the weevil is also influenced by the presence or absence of new areas attractive to the adults, since if no areas containing fresh stumps are available elsewhere, the adults may remain in the hibernating area. In districts where regular felling has not recently been practised, populations should be low, and a test in Connecticut in 1939 showed that under these conditions planting can safely be performed in the first season after felling.

Observations on the value of trap-logs in the control of elm bark-beetles are reported by P. P. Wallace (pp. 537-541). Traps, each comprising ten newly-felled elm logs with a total average bark area of $78\frac{1}{2}$ sq. ft. and arranged in a single layer on sleepers raising them a few inches above the ground, were left in position from May or early June until the second week in July. One sample consisting of a strip of bark 12 ins. long and as wide as the circumference of the log was taken in the first week in July from each of 18 traps set in a town in which both *Scolytus multistriatus*, Marsh., and *Hylastes (Hylurgopinus) rufipes*, Eichh., were common. The numbers of brood galleries per sample ranged from 0 to 19 and averaged 2.7 for *Scolytus* and from 0 to 96, with an average of 27.1, for *Hylastes*. Totals of 24 brood galleries of the former and 512 of the latter were present in the 18 samples, and the numbers of adults of these species entering the traps were estimated as 2,880 and 61,440, respectively. The number of

galleries of *S. multistriatus* per sample is equivalent to a light infestation of 2 per sq. ft. ; brood galleries constructed in other material by second-generation adults were subsequently found to average 9 per sq. ft., and a very large number of traps would therefore be required to produce any considerable decrease in the population. Records kept from August 1940 until July 1941 of the emergence of *S. multistriatus* and of Hymenopterous parasites from sections of a heavily infested elm that were 18 ins. long and 1-7 ins. in diameter showed that there is no correlation between the abundance of parasites and the diameter of the logs. Emergence of parasites was greatest from the logs from which most adults of *Scolytus* emerged, but other bark- and wood-boring larvae were also present. Surveys in various districts showed that *S. sulcatus*, Lec., which is also a vector of the fungus [*Ceratostomella ulmi*] causing Dutch elm disease [29 119], occurs more frequently in Connecticut than was formerly believed. It is not considered of any importance as a vector, but owing to its habits of feeding in twig crotches and breeding in dead and dying trees of other species, it may harbour the fungus for long periods. In addition to elm, it has been recorded in Connecticut on plum, cherry, apple and pear.

A section comprising shorter notes on miscellaneous insect pests by Johnson (pp. 541-546) includes records of damage to seedlings of English ivy [*Hedera helix*] and columbine [*Aquilegia*] by *Calomycterus setarius*, Roel., and of the finding of larvae of *Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., and *Macro-dactylus subspinosus*, F., and a few adults of *Lachnosterna tristis* on 25th April on the surface of the soil under heavy burlap mats covering seed-beds in a forest nursery. Larvae of *Nephelodes emmedonia* var. *violans*, Gn., attacked grass along the verges and centre of a highway in May ; injury, which varied in intensity, was severe over an area of at least 50 acres. This is the first outbreak of this Noctuid in Connecticut for over 40 years. In further experiments on the control of *Blissus hirtus*, Montd. [30 552], tobacco dust containing 1 per cent. nicotine and rotenone dusts containing 0.5 and 1 per cent. rotenone applied at the rate of 25 lb. per 1,000 sq. ft. to very dense turf with a high proportion of bent grass [*Agrostis*] gave approximately equal results. The density of the turf influences the degree of control obtained, and the method of application should therefore permit the dust to be well worked into it. Nine females of *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., that had evidently survived the winter were collected from debris at the bases of upright Japanese yew (*Taxus cuspidata capitata*) on 29th April 1941 and caged with yew foliage on 1st May. Three of them survived until early in 1942 and laid eggs each month until they died. The total numbers deposited were 1,114, 1,731 and 2,429 [cf. 21 195].

G. H. Plumb & A. DeCaprio report (pp. 546-547) that an outbreak of *Symmerista albifrons*, S. & A., occurred in woodland in a town in Connecticut in October 1940, an area of 5-10 acres being heavily infested. The adults of this Notodontid appear in June and the females oviposit on the lower surface of the leaves ; the larvae hatch in about two weeks and feed on the leaves until August or early September, when they pupate and overwinter in cocoons among debris on the ground. Observations in August 1941 showed that oaks comprised the bulk of the stand and were the preferred food-plants.

BEARD (R. L.) & TURNER (N.). **Investigations on the Control of the European Corn Borer.**—*Bull. Conn. agric. Exp. Sta.* no. 462 pp. 551-591, 16 figs., 31 refs. New Haven, Conn., 1942.

Many of the results of the investigations on the European corn borer [*Pyrausta nubilalis*, Hb.] in Connecticut during 1936-41 reported in this bulletin have already been noticed [R.A.E., A 29 162 ; 30 550]. In the first part, R. L. Beard (pp. 551-566) describes observations in 1940-41 on the situation of eggs and larvae on sweet maize at different stages in its development, after reviewing previous work on the subject and quoting a classification of growth stages.

devised for sweet maize by C. H. Batchelder. No eggs were laid on plants in the seedling or pre-whorl stages, and relatively few on plants on which the leaf-whorl was composed of fewer than 8-9 leaves and completely enclosed the tassel, while there was a tendency for the older stages to be preferred as the season progressed. When eggs were deposited on plants in which the tassel was not yet visible at the bottom of the whorl, few of the larvae from them became established on the plant; beyond this stage, survival increased with the age of the plant at the time of oviposition. Plants that have not reached this stage when the moths are active are not likely to be severely infested.

Experiments on control are described by N. Turner (pp. 568-591). Sprays and dusts were both effective, but the latter were chiefly studied as they are preferred by growers. No consistent advantage was derived from the inclusion of spreading agents in suspensions in water of pure ground derris root or of ground cubé root. Inert dusts impregnated with extracts of pure ground derris root (0.15 per cent. rotenone) or of pyrethrum flowers (0.2 per cent. pyrethrins) were not significantly less effective than a derris dust containing 1 per cent. rotenone, but dual-fixed nicotine dust containing 4 per cent. nicotine was consistently more effective than the latter. Nicotine bentonite was more toxic than dual-fixed nicotine when the nicotine content of each was 2 per cent., but not when it was 4 per cent.; a nicotine content of 11 per cent. is required for nicotine bentonite to be as effective as dual-fixed nicotine containing 4 per cent. nicotine. None of the modifications of the standard schedule of four treatments at five-day intervals was more effective than the standard against the first generation, and the evidence indicated that under the conditions of the experiments and where treatment is confined to the hatching period, the number of applications is of greater importance than their timing. Treating the ears only, which was effective in 1940 [30 550], was unsuccessful in 1941. Dissection of plants three or four days after each treatment of the standard schedule indicated that no one treatment was more effective than any other, and that the control obtained was due to a general reduction in the population over the whole plant. Ear infestation seemed to be from newly hatched larvae, and not from partly-grown larvae migrating from other parts of the plant.

EMMERT (E. M.) & PRICE (W. A.). **Control of the Corn Earworm by Clipping.**—*Bull. Ky agric. Exp. Sta.* no. 436, 10 pp., 4 figs., 6 refs. Lexington, Ky., 1942.

An outline is given of the bionomics of *Heliothis armigera*, Hb. (*obsoleta*, F.) in Kentucky, where it is very injurious to the ears of sweet maize, and experiments carried out in 1933-41 are described in which the percentages of ears infested were greatly reduced by clipping off the tips with a pair of shears at or near the ends of the cobs [*cf. R.A.E.*, A 23 520, etc.]. Pinching the ears was also tried, but proved unsatisfactory. The clipping was carried out 1-2, 4-6 or 8-10 days after pollination, which was considered to be complete when most of the silks had begun to brown and some had begun to dry, in July on early-planted maize and in August on the late crop, and all the ears were treated. If a larva had penetrated beyond the first clip, as shown by a small brown discoloration, additional cuts were made until the discoloration was removed. The clippings were buried, submerged in water or burnt to destroy the eggs and larvae in them. The treatment was found to be most effective when applied 4-6 days after pollination, when it reduced infestation from about 60 to about 10 per cent. A second clipping was not necessary, but might be desirable in the case of a very heavy attack. In 1941, clipping the ears gave better control in six treatments on different dates than injecting oil containing pyrethrum extract [*cf. 30 267*, etc.], the average percentages of ears infested being 13.2 and 23.9, respectively, as compared with 45.7 in untreated plots; moreover, it took less than half as much time and involved no expense for equipment.

MACKIE (D. B.). **Reports of Pest Investigations and Treatments Committee.**—*Spec. Publ. Calif. Dep. Agric.* no. 189 pp. 13–15, 64–66. Sacramento, Calif., 1942.

In the first of these reports of a committee of the Western Plant Board, three treatments are described that were found to be effective against the grape phylloxera [*Phylloxera vitifoliae*, Fitch] on vines. They are submerging the vines for 3–5 minutes in water of which the temperature is not below 125° or above 130°F., submerging them for not less than 10 minutes in a mixture of 1½ gals. medium summer oil of 72–80 seconds viscosity with an unsulphonatable residue of 95 per cent. or more, 1 pint nicotine sulphate and 1 pint sulphated alcohol liquid spreader, made up to 100 gals. with water, or fumigating them at atmospheric pressure in a fumigation chamber with methyl bromide at the rate of 2 lb. per 1,000 cu. ft. for 3 hours at a temperature of 65°F. or more. In each case the whole vine, previously washed free from soil, is treated; the nicotine dip should be well stirred before each treatment and renewed after treating four lots of vines and at least once every 24 hours. Fumigation of deciduous nursery stock with methyl bromide at the rate of 2 lb. per 1,000 cu. ft. for 3 hours at temperatures above 70°F. or at 3 lb. at temperatures between 60 and 70°F. is effective against the oriental fruit moth [*Cydia molesta*, Busck] and also against insect pests of nut stocks, including *Acrobasis juglandis*, LeBaron, *A. caryae*, Grote, and *Enarmonia (Laspeyresia) caryana*, Fitch.

In the second report, it is stated that potato tubers are not injured by exposure to methyl bromide at dosages of up to 3 lb. per 1,000 cu. ft. for 3 hours. As a result of investigations in Oregon, it has been found that *Cryptorrhynchus lapathi*, L., can be destroyed on dormant nursery stock of poplar, willow and birch by fumigation for 2 hours with 3 lb. per 1,000 cu. ft. Injury to tomatoes fumigated with 2 lb. per 1,000 cu. ft. for 2 hours was found to be due to insufficient ventilation, and has not occurred where this has been adequate. *Parlatoria camelliae*, Comst., on *Camellia* is readily controlled by methyl bromide at temperatures as low as 75°F. in winter, when no eggs are present, but less so as the eggs hatch and when all stages occur together in spring.

LAUDERDALE (J. L. E.). **Egyptian Alfalfa Weevil, *Hypera brunneipennis*, Boh.**—*Spec. Publ. Calif. Dep. Agric.* no. 189 pp. 32–34. Sacramento, Calif., 1942.

MCDUFFIE (W. C.). **The present Status of the Legume Weevil *Hypera brunneipennis* Boh. in Yuma Valley, Arizona.**—*T.c.* pp. 109–116.

The first of these papers contains an account of investigations in 1940 on the occurrence and bionomics of *Hypera brunneipennis*, Boh., in the Yuma Valley, Arizona [cf. *R.A.E.*, A 30 172]. In an attempt in February 1940 to eradicate a light infestation that occurred in a date garden near Tempe, Arizona, near palms received from Yuma in 1937 or 1938, all clover and lucerne in the infested area was sprayed with calcium arsenate (2 lb. per 100 U.S. gals. water) on 13th, 23rd and 30th March; this treatment appeared to be effective, since living larvae were very difficult to find after the first application. Early in April the plants were disked under and hoed in round the bases of the palms and the whole area subsequently treated with a weed burner, flooded, and again disked. The larvae are susceptible to cold, and many were apparently killed by it in the Yuma Valley in January and February 1940.

In the second paper, the author summarises the information obtained during investigations in 1939–41. The adults emerge mostly in March and April, feed heavily for 2–3 weeks and then aestivate until November, when they resume feeding. Oviposition begins in December and is completed by April. In lucerne fields, most of the eggs are laid in surface litter, but in sour clover [*Melilotus indica*] an increasing number are laid in the growing stems as the

season advances. Fewer eggs were produced on lucerne in the laboratory than on other plants. The eggs hatch in about 4 weeks in January and 8–10 days in the second half of April, the larval stage lasts 31–33 days early in the season and 17–21 in March–April, and the pupal stage ranges from 13–15 days in February–March to about a week in April. Of 25 commonly-grown leguminous plants, sour clover and bur clover [*Medicago denticulata*] were the most suitable food-plants; larvae completed their development on potted plants of lucerne, soy bean and various other clovers, but not on string beans. Injury has largely been confined to self-sown sour clover, which in general is not of economic importance in this district, but bur-clover pasture covering an area of about 50 acres was damaged and the first crop of lucerne in a very thin stand was lost as a result of feeding early in the season, before sour clover was available, by larvae derived from populations built up on sour clover in the previous year. Except under these conditions, the weevil is unlikely to become of economic importance [cf. 31 466], since no other material damage to lucerne was reported, even where it was intermixed with sour clover.

In small experimental plots, satisfactory control was obtained by sprays or dusts of calcium arsenate applied at the rate of 2–4 lb. per acre or of a commercial cryolite mixture containing 45 per cent. sodium fluoaluminate at the rate of 20 lb. per acre; the sprays were slightly more satisfactory than the dusts. Cutting and pasturing in January or harvesting in February was not effective, but 80 per cent. of the larvae were destroyed by pasturing cattle and sheep in the fields in March and April, when larvae are abundant.

The isolated situation of the infested area, the habits of the weevil, and the precautionary fumigation of such products as lucerne hay and date-palm offshoots have prevented its spread from Yuma. The most likely means of spread appears to be by traffic along roads and in products such as lucerne hay, date-palm offshoots and threshed flax seed if this is not handled in such a manner as to prevent the escape of any weevils present in it.

JONES (S. C.). **Host Relationship of the white-banded Cherry Fruit-fly** *Rhagoletis cingulata* Loew and certain closely related Species of the Genus *Rhagoletis*.—*Spec. Publ. Calif. Dep. Agric.* no. 189 pp. 44–46, 2 refs. Sacramento, Calif., 1942.

Surveys subsequent to the finding in 1930 of fruit-flies on wild bitter cherry (*Prunus emarginata*) in a cherry fruit-fly eradication zone in Hood River County, Oregon, showed that *P. emarginata* outside the zone was infested by a species of *Rhagoletis*, while cultivated cherries, even close to them, were not. The species was later described by Curran as *R. indifferens* [*R.A.E.*, A 20 464], but C. H. Greene, F. H. Benjamin and A. Stone all concluded that it was not distinct from *R. cingulata*, Lw. [cf. also 25 471]. Limited biological studies indicated that *P. emarginata* is its preferred food-plant. Examination of the male genitalia showed that, if they are distinct, both *R. cingulata* and *R. indifferens* are present on *P. emarginata* in Hood River County, but that only *R. cingulata* occurs on this plant at two other places in Oregon and one in Washington. Surveys in ten northern counties of Oregon in August 1940 showed that *P. demissa* is nowhere infested by larvae of *Rhagoletis*, but that *P. emarginata* is infested in three counties, in one of which uninfested *P. demissa* and infested *P. emarginata* were growing side by side.

In the Willamette Valley and Hood River, the fruits of *P. emarginata* ripen only slightly later than late varieties of cultivated cherries [cf. 29 222], which are frequently heavily infested by fruit-flies, whereas early varieties are not, and it is concluded that cultivated cherries at low altitudes that are harvested before the fruits of *P. emarginata* ripen at higher altitudes are likely to escape infestation.

Owing to doubts as to the status of *R. indifferens*, which infests *P. emarginata* in unquarantined counties in California and Oregon, attempts are being made to cross adults reared from *P. emarginata* in these two States with those of *R. cingulata*.

MACKIE (D. B.). **Development in Quarantine-Entomology in California.**—*Spec. Publ. Calif. Dep. Agric.* no. 189 pp. 48–55. Sacramento, Calif., 1942.

Part of this historical review of the treatments developed in California to make possible the movement of agricultural products subject to quarantine regulations against insect pests is devoted to work on methyl bromide, which allows a wide margin between the dosages lethal to insects and those injurious to plants. The quantities given are those used per 1,000 cu. ft. Many Coccids are destroyed with $\frac{1}{2}$ lb. for 4 hours at 85°F., and for mealybugs and Tetranychid mites even $\frac{1}{4}$ lb. for 12 hours at 70°F. is sufficient. Vacuum fumigation with $2\frac{1}{2}$ lb. for $1\frac{1}{2}$ hours kills a wide range of insects, and the larvae of many of them are destroyed by atmospheric fumigation with 2 lb. for 2 hours. Insects in sacked or bulk grain, meal or flour are killed by exposure for 24 hours to 1 lb. at temperatures as low as 55°F. For shorter exposures, greatly increased dosages appear necessary at temperatures below 70°F.

Nursery stock infested by the peach root borer (*Aegeria opalescens*, Edw.) can be effectively treated by submerging it to a point 10 ins. above the root crown in a solution of 40 per cent. nicotine sulphate (1 : 400), placing the container in a vacuum fumigator, and exhausting the air to a 27-in. vacuum. The air is thus drawn out of the larval burrows and, when atmospheric pressure is restored, they become filled with the solution, which kills all the larvae.

MACKIE (D. B.). **Report of the special Committee to investigate the Alfalfa Weevil** (*Hypera postica*).—*Spec. Publ. Calif. Dep. Agric.* no. 189 pp. 69–77, 1 map. Sacramento, Calif., 1942.

In consequence of this report on the spread of *Hypera variabilis*, Hbst. (*postica*, Gylh.) on lucerne in the United States, the factors influencing this, and the possibility of its distribution in some of the States in the Great Plains area and the Mississippi Valley that are as yet uninfested, the Western Plant Board adopted a motion for the uniform revocation of quarantines against it in the Western States [cf. *R.A.E.*, A **23** 135; **25** 178]. Its distribution appears to be limited by natural factors, since it has spread more to the west in spite of quarantines, than to the east of the Salt Lake Valley, where it was first observed in the United States, and of these factors climate is regarded as the most important [cf. **29** 402]. Limitations are imposed by a mean summer temperature of 77°F., above which the weevil aestivates, and a mean winter temperature of 23°F., below which it becomes of no economic significance, and a map is given showing the infested areas in the United States and the courses of the isotherms for these mean temperatures (each based on a ten-year period) across the States to the east of them. Other factors may reduce the importance of the weevil within the areas that are climatically favourable. In some districts, climatic conditions are even more suitable to the parasite, *Bathyplectes curculionis*, Thoms. [cf. **29** 401] than to the weevil, and in Salt Lake Valley the latter is attacked by *Beauveria* (*Sporotrichum*) *globulifera* and *Entomophthora* (*Empusa*) *sphaerosperma*, which are normally parasitic on *H. punctata*, F. As these fungi are most effective in seasons in which spring rainfall is heavy, their influence is likely to be greatest in districts where this condition is normal. Since the importance of *H. variabilis* throughout the infested area is in general slight and has not varied much in recent years, it is concluded that it has reached the climatic limits of its distribution.

HAWKINS (L. A.). **New Developments in Pest Treatments.**—*Spec. Publ. Calif. Dep. Agric.* no. 189 pp. 117–122. Sacramento, Calif., 1942.

This is an account of research in the United States on the fumigation of nursery stock, fruit and vegetables with methyl bromide since June 1938. In that year, it was known that larvae and pupae of the oriental fruit moth [*Cydia molesta*, Busck] on nursery stock are destroyed by exposure for 4 hours to 3 lb. per 1,000 cu. ft. at 70°F., and stock treated with 3½ lb. under these conditions was accepted by many States in which the moth did not occur. The higher rate caused some injury to certain kinds of nursery stock, notably apple, but later work showed that fumigation for 4 hours with 3 or 2 lb. at temperatures not lower than 60 or 70°F., respectively, was effective against all stages and could safely be applied to most deciduous stock, particularly if the trees were dormant and were sprinkled with water before fumigation.

In work on the treatment of sweet-potato tubers and plants [*cf. R.A.E.*, A 31 401] for the control of the sweet-potato weevil [*Cylas formicarius*, F.], fumigation with 3½ lb. for 4 hours at 75°F. or more proved practicable for seed tubers where a loss of 2–3 per cent. through decay [29 413] is not important. The yield of high-quality tubers from 160,000 treated plants of two varieties commonly grown in Louisiana and Alabama was slightly higher than that from untreated controls. Complete mortality of the weevil in the draws is given by exposure for 4 hours to 10 oz. per 1,000 cu. ft. at 80°F. In the eastern States, all stages of the potato tuber moth [*Gnorimoschema operculella*, Zell.] in potato tubers are completely destroyed by fumigation with 2·4 lb. per 1,000 cu. ft. for 3 hours at 80°F.

A description of a fumigation chamber for use with methyl bromide is appended, and the need for good circulation of the air during both the heating and the fumigating processes and good ventilation while the fumigant is being exhausted is emphasised.

BATEN (W. D.) & MARSHALL (R. E.). **Some Methods for approximate Prediction of Surface Area of Fruits.**—*J. agric. Res.* 66 no. 10 pp. 357–373, 7 figs., 4 refs. Washington, D.C., 1943.

Since it is sometimes desirable to know the surface area of fruits for use in investigations relating to spray coverage or spray-residue removal, a study was carried out in Michigan in 1940–41 to determine whether satisfactory mathematical equations could be developed to facilitate approximate predictions of surface areas of different varieties and kinds of fruits at different stages of growth or maturity. The equations and their standard errors, etc., are given in numerous tables. The results indicate that the standard errors obtained by predicting surface areas from areas of transverse cross section, transverse diameter and weights of fruits were smaller than those for other measurements tried, and any one of these may be used to predict approximate surface areas; a method is given for determining which of two such variables is the better for predicting a third variable. The most practical predicting equation for harvested apples is based on weight and the most suitable one for unpicked apples on transverse diameter. An average predicting equation may be used for several varieties of the same kind of fruit with standard errors of estimate nearly as low as that for an equation based on a single variety. There appears to be a fairly constant relationship between surface areas and weights of apples during several weeks before maturity.

Weights of pears and plums may be used to predict surface areas of these fruits, and an average predicting equation may be used with reasonable accuracy for several pear varieties having a wide range of shapes.

PARR (T.). **Voltage Gradients in Trees as an Indicator of Susceptibility to Insect Attack.**—*J. For.* **41** no. 6 pp. 417–421, 6 figs., 7 refs. Washington, D.C., 1943.

In laboratory and field experiments in New England and New York in 1939–40, the voltage gradient of trees of *Pinus rigida*, *P. resinosa*, *P. strobus* and *Picea rubra* was measured by means of a portable vacuum-tube millivoltmeter, the electrode tips of which were placed approximately on the cambium, one inch apart, on the longitudinal axis of the stem of trees 0.5–26 inches in diameter. The readings obtained on living trees were fairly consistent and varied comparatively little between trees of different size and age or between trees of different species. In normal trees, the voltage gradient is positive (*i.e.* the electrode nearer to the growing tip is electropositive to the other) in spring and becomes negative later in the summer, whereas the cycle is at least partially reversed in trees that are subnormal, but with no external evidence of lowered vitality. The best time to obtain readings in the field is in the spring and early summer or in autumn after gradient reversals in the stand have taken place.

These results may be of importance in insect control if it is possible to tell when trees have reached a physiological condition in which they are susceptible to attack by bark-beetles or borers, since such trees may be removed. Observations on four or five species of deciduous trees indicated that their voltage gradients follow the same trends and are of about the same magnitude as those of conifers.

HARTNACK (H.). **Unbidden House Guests. Vol. 1.**—Med. 8vo, i pp. 1–226, ii pp. 1–62, iii pp. 1–112, v pp. 1–142 [+18], ill. Tacoma, Wash., Hartnack Publ. Co., 1943. Price \$12 plus postage.

This book, which deals in a popular manner with the plant and animal pests associated with houses, chiefly in the United States, includes much of the information contained in a previous one [*R.A.E.*, A **27** 382], but its scope is wider and the information considerably augmented. In addition to household pests, those associated with stored grain, drinking water and swimming pools, and garbage are also dealt with. The book is in four parts, of which the last three deal systematically with plants, invertebrates (including ticks and mites, but excluding insects, to which a subsequent volume will be devoted) and vertebrates, and contain notes on the appearance, habits and control of individual species. The first part includes information, illustrated to a large extent by reference to insects, on the climatic conditions in houses, the factors influencing the spread and establishment of household pests throughout the world, and the evidence whereby the presence of many of them can be recognised. General methods of control are briefly outlined, and the desirability of preventing infestation by constructional methods is stressed.

WHITCOMB jr. (W.). **The Wax Moth and its Control.**—*Circ. U.S. Dep. Agric.* no. 386, 10 pp., 5 figs. Washington, D.C., 1942.

In this revised account of the life-history and control of *Galleria mellonella*, L., which causes considerable damage in beehives and stored combs and comb-honey in the United States [*cf. R.A.E.*, A **24** 563], it is pointed out that stored combs are less subject to infestation if they are exposed to the light, by setting the supers on end, and spaced to allow ventilation and that paradichlorobenzene is unsatisfactory for fumigating honey stored in comb sections or in frames, since its odour is readily absorbed and held by the honey. Carbon bisulphide is considered the most satisfactory fumigant for stored honey, but calcium

cyanide dust can also be used if placed in a container. Honey should not be exposed to any fumigant for long periods and is best protected by prompt extraction.

TOWNSEND (C. H. T.). **Manual of Myiology. Part XII. General Consideration of the Oestromuscaria.**—Med. 8vo, 365 pp., frontis., 78 pls., 62 pp. refs. Itaquaquecetuba, São Paulo, Charles Townsend & Filhos, 1942.

One chapter of this volume deals with the relation of the flies to man and includes a brief discussion of their importance as parasites of some of the major groups of insect pests of agricultural crops, in which lists are given of the tribes or genera of flies concerned, and a note on their rearing and use for biological control.

TRAVASSOS filho (L.) & CARRERA (M.). *Xanthozona melanopyga* (Wiedmann, 1830) (Diptera : Tachinidae) predadora de *Brassolis astyra* Godart, 1824 (Lepidoptera : Brassolidae), praga das palmeiras. Dados bionômicos dos dois insetos e morfológicos do taquinídeo. [*X. melanopyga*, a Parasite of *B. astyra*, a Pest of Palms. Biological Data for the two Insects and morphological Data for the Tachinid.]—*Arq. Zool. S. Paulo* 3 pp. 43-74, 9 pls. (1 col.), 27 refs. São Paulo, 1941. (With a Summary in English.) [Recd. 1943.]

In October 1939, the authors received 75 full-fed larvae of *Brassolis astyra*, Godt., that had been taken from a larval nest on the trunk of an ornamental palm (*Cocos romanzoffiana*) in São Paulo. They pupated almost immediately, without feeding on the palm leaves offered to them, and adults emerged about a month later, together with a few examples of a Tachinid that was identified as *Xanthozona melanopyga*, Wied. The larva, pupa and adults of this parasite are described, and notes are given on its development in the pupa of *B. astyra*. This butterfly has been recorded from several States in Brazil, where the larvae feed on the leaves of palms (including coconut and date palm), banana and sugarcane. *C. romanzoffiana* appears to be its preferred food-plant in São Paulo. The larvae leave their nest to feed at night and ascend the trunk to the leaves. When full-fed, they leave the palm to pupate, and their cocoons have been observed on the walls of houses and on other raised objects. The authors have observed the adults on the wing at night from October to December.

WILLE (J. E.) & GARCÍA RADA (G.). **Los insectos y las enfermedades del lino.** [The Insect Pests and Diseases of Flax.]—*Inf. Estac. exp. agric. La Molina* no. 54, 19 pp., 4 col. pls., 5 figs. Lima, 1942.

The first part (pp. 1-9) of this bulletin is by Wille and deals with insects. Flax is a fairly new crop in Peru and is being cultivated on a large scale in some of the coastal valleys. The young plants are attacked at ground level by cutworms, chiefly *Laphygma frugiperda*, S. & A., *L. (Xylomyges) eridania*, Cram., and *Feltia experta*, Wlk., and the larvae of *L. eridania* often climb up the plant and defoliate it. The leaves are also attacked by another Noctuid, *Anticarsia gemmatilis*, Hb., an Arctiid of the genus *Halisidota* and the leaf-mining larvae of *Agromyza (Liriomyza) flaveola*, Fall., which pupate just below the soil surface. The larvae of *Agromyza virens*, Lw., mine the stem and pupate in the base of the plant. Up to 50 per cent. of them are parasitised by Chalcidoids, and they are not particularly common. The fruit capsules and floral buds are occasionally destroyed by the larvae of *Heliothis virescens*, F., and the terminal shoots by those of the Tortricid, *Epinotia opposita*, Heinr., which bore into them and spin the young leaves together. All these pests of

flax are best avoided by a 2-3 year crop rotation, and by sowing in June, when the low winter temperatures are unfavourable to them. The cutworms can be controlled by a poison bait, and they and the leaf-eating caterpillars by arsenical sprays or dusts.

Flax seed stored for some months is sometimes attacked by *Ephestia elutella*, Hb., against which fumigation with carbon bisulphide at the rate of 13 oz. per 100 cu. ft. for 24 hours is recommended.

13a Memoria de la Estación experimental agrícola de La Molina correspondiente al año 1940. [Report of the Agricultural Experiment Station at La Molina for the Year 1940.]—vii+321 pp., illus. Lima, Minist. Fom. Peru, 1941. [Recd. 1943.]

This report includes sections by J. E. Wille (pp. 149-188) on insect pests and their control in Peru in 1940, and by J. Lamas C. (pp. 189-200) on work at the entomological substation at Pativilca as well as a paper noticed below [see next abstract]. About two-thirds of Wille's report is devoted to pests of cotton and the rest includes brief records of a large number of insects on many other crops. *Mescinia peruella*, Schaus, injured cotton bolls as in previous years [cf. *R.A.E.*, A 29 509, etc.], and *Heliothis virescens*, F., was again very harmful to cotton in the Cañete Valley. It is customary during the season to make up to 12 applications of an arsenical dust against *Heliothis*, beginning when 20 eggs per 100 plants are observed on the terminal shoots, but as infestation is patchy, this practice often leads to unnecessary treatment of large areas. The excessive use of arsenicals results in outbreaks of *Aphis gossypii*, Glov., and furthermore, the poison is effective only against larvae on young plants, on which the scarcity of bolls compels feeding on the leaves; 1 or 2 applications to the terminal shoots made by hand are sufficient to control the infestation at this stage. Once the larvae have entered the buds and bolls, treatment with arsenicals is of little use. *Dysdercus ruficollis* L., suddenly increased, particularly in the neighbourhood of the wild malvaceous plant, *Sida paniculata*, owing to favourable weather and decreased parasitism by the Tachinids, *Acaulona peruviana*, Tns., and *Paraphoranthia peruviana*, Tns. *Pinnaspis* (*Hemichionaspis*) *minor*, Mask., which was of no practical importance on cotton, was observed for the first time on *Abutilon cordatum*, and *Anthonomus vestitus*, Boh., on *Althaea rosea*. Up to 90 per cent. of the larvae of this weevil on cotton in autumn and winter were parasitised by *Microbracon vestitica*, Vier. *Anomis texana*, Ril., was again parasitised by *Blondelia* (*Eucelatoria*) *australis*, Tns., up to 80 per cent. of the larvae being attacked in January. *Alabama argillacea*, Hb., and *Bucculatrix thurberiella*, Busck, were numerous in two valleys.

Aphis gossypii has increased in economic importance on cotton of recent years. It is normally numerous at two periods during the season, in spring (September-November) and again in February and March, but is controlled by natural enemies in December and January. The spring outbreak begins on ratoon cotton, and spreads to planted cotton, on which the Aphids cause severe curling of the leaves and shoots. The summer outbreak, which is attributed to the destruction of natural enemies owing to the use of arsenical dusts [31 10], begins in the ratoon or planted cotton and results less in leaf curl than in abundance of honeydew, which covers the leaves, causing partial or total loss of foliage and a great reduction in crop. In 1940, the spring infestation was controlled by *Aphidius phorodontis*, Ashm., *Cycloneda sanguinea*, L., and *Scymnus* sp., but the summer outbreak caused injury that varied in severity with the frequency and rates of applications of arsenicals. Where mixed dusts of sulphur and calcium arsenate (1 : 1 or 1 : 2) were applied, however, the Aphid was less numerous and relatively well controlled by natural enemies. Larvae of

Platyedra (*Pectinophora*) *gossypiella*, Saund., were intercepted in cotton seed imported from São Paulo, Brazil, with an official certificate, and measures were suggested to guard against its introduction from Ecuador [cf. 29 539], where it has been found on cotton in the Province of Manabí. *Corythaica monacha*, Stål (*costata*, Gibson) caused serious losses in two valleys. An account is given of experiments on the effect on *Anomis texana* and *D. ruficollis* of adding selenium to the soil [31 120].

The other pests recorded include some found on tea; the most injurious was a leaf-curling Aphid, which was parasitised by *Aphidius*, and the others were *Coccus* (*Lecanium*) *hesperidum*, L., which was heavily parasitised by Chalcidoids, *Pseudococcus maritimus*, Ehrh., adults of *Macroductylus* sp. and larvae of *Samia* sp. Cacao was infested by the Berytid, *Parajalysus spinosus*, Dist., a Capsid of the genus *Monalonion* and a Pentatomid of the genus *Apateticus*, and coffee by *Leucoptera coffeella*, Guér. The distribution of *Aphelinus mali*, Hald., against *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., on apple was continued. *Ascogaster quadridentata*, Wesm. (*carpocapsae*, Vier.), which was released in Lima against *Cydia* (*Carpocapsa*) *pomonella*, L., on apple [cf. 29 511], has not proved successful, though it has probably survived in small numbers.

The entomological substation established in 1936 for work on cotton pests [27 385] was transferred to the Pativilca Valley in 1940. In this zone, *D. ruficollis* is the chief pest, and has caused serious losses. Details are given of its frequency during the season, which is thought to depend on climate. There is some evidence that infestation is heavy in every second year, but the causes of this are not known. It is parasitised by *Acanlona peruviana* and *Paraphor-antha peruviana*, but the percentage parasitism did not exceed 23.4. Its principal wild food-plant was *Sida paniculata*, which was also infested by *D. minus*, Say, an occasional pest of cotton. Pests of other crops in this region included *Laphygma frugiperda*, S. & A., *Laphygma* (*Xylomyges*) *sunia*, Gn., and *Elasmopalpus lignosellus*, Zell., on flax, *Oscinella* (*Oscinis*) *frit*, L., which caused slight injury to wheat, and the Scolytid, *Pagiocerus frontalis*, F., on avocado.

LAMAS C. (J. M.) & MEUCHE (A.). **Larvas de la mosca (*Opomyza florum* Fabr.) y de otros Dípteros en los cereales de invierno, en los alrededores de Bonn.** [The Larvae of *O. florum* and of other Diptera in Winter Cereals in the Neighbourhood of Bonn.]—13a Mem. Estac. exp. agric. La Molina 1940 pp. 213–218, 3 refs. Lima, Minist. Fom. Peru, 1941. (Translation from German in *Anz. Schädlingsk.* 16 no. 7 pp. 75–78. Berlin, 1940.) [Recd. 1943.]

Withered shoots of winter rye, barley and two varieties of wheat in an experimental field at Bonn, in Germany, were found in early May 1939 to contain numerous third-instar larvae of *Opomyza florum*, F., together with larvae of *Sciara fenestralis*, Zett. Investigations showed that of 50 plants of each, 43, 4, 35 and 32, respectively, were infested by the former, and 30, 2, 0 and 3 by the latter. Barley was uninfested if wheat and rye were nearby. The percentage of rye plants attacked decreased as the date of sowing advanced from 15th September to 27th October. Notes are given from the literature on the ecology and biology of *O. florum* [cf. R.A.E., A 22 1]; little is known of its occurrence in Germany, possibly because it has been confused with *Oscinella* (*Oscinis*) *frit*, L. At Bonn, pupation occurred in the leaves and shoots from the end of May to mid-June and adults were present from early June until the end of October. Other flies of which larvae were observed in shoots of rye were *Leptocera fenestralis*, Fall., *Aphanotrigonum trilineatum*, Mg., *Elachiptera cornuta*, Fall., *Chlorops* (*Oscinis*) *pumilionis*, Bjerk., and a Chironomid of the genus *Euphaenocladius*. Another Chironomid, bred from the roots of rye, was found to be

an undescribed species of *Gymnometriocnemus* by Goetghebuer, who proposed to name it *G. terrestris*.

Observations on Species of Lepidoptera infesting Stored Products. I-XI.—

Entomologist **76** pp. 25–30, 1 pl., 8 figs.; pp. 65–67, 14 figs., 1 ref.; pp. 95–96; pp. 113–114; pp. 115–116, 4 figs.; pp. 129–132, 5 figs.; pp. 168–170; pp. 177–181, 12 figs., 7 refs.; pp. 182–184, 2 figs., 3 refs. London, 1943.

A. S. Corbet & W. H. T. Tams (pp. 25–30) give revisional notes on species of the Tineid genera *Aglossa* and *Achroia*. H. E. Hinton (pp. 65–67) distinguishes the larvae of *Hofmannophila* (*Borkhausenia*) *pseudospretella*, Staint., and *Endrosis lactella*, Schiff., for which he uses the name *sarcitrella*, L. [cf. *R.A.E.*, A 31 310]. Corbet (pp. 95–96) discusses the characters distinguishing the species of the *Tinea granella* complex occurring in Britain. They comprise *T. granella*, L., *T. cloacella*, Haw., *T. ruricolella*, Staint., and *T. infimella*, H.-S., of which *T. personella*, Pierce & Metcalfe, has been found to be a synonym. Corbet & Tams (pp. 113–114) consider that Geoffroy (1762) is the original author of the genus *Tinea*, adopt his spelling (*Tinaea*) and select *T. pellionella*, L., as the type. Corbet (pp. 115–116) gives characters distinguishing *T. insectella*, F., and *T. ditella*, Pierce & Metcalfe, on male and female genitalia. Corbet & Tams (p. 129) record the distribution and synonymy of *Euchromius ocellae*, Haw., and the characters distinguishing *E. californicalis*, Pack., from it. They also (pp. 130–132) give characters distinguishing *Trichophaga tapetzella*, L., *T. abruptella*, Woll., and *T. perna*, sp. n. Specimens of the latter have been received from various parts of tropical Africa and Asia and some, bred from woollen socks, from Fiji. The same authors (pp. 168–170) give the characters distinguishing *Pyralis pictalis*, Curt., and *P. manihotalis*, Gn., with records of their distribution. H. Stringer (pp. 177–181) records the breeding of the Tineid, *Lindera tessellatella*, Blanch., in floor-sweepings in a mill in England, re-describes the genus and species and quotes descriptions of the genitalia of the latter by A. Philpott. Hinton & R. M. Greenslade (pp. 182–184) discuss the moths found infesting a hundred-weight of bird guano in England. They comprised *Endrosis sarcitrella* [*lactella*], *Hofmannophila pseudospretella*, *Trichophaga tapetzella*, *Monopis rusticella*, Cl., *Tinea granella* and *T. pellionella*, but the males of *T. pellionella* had atypical genitalia so that the identification is not certain. The guano had been in England for several years and had probably been infested after arrival. A key is given to the pupae of the moths, all of which are common pests in houses and warehouses. One larva of *Ptinus fur*, L., and three species of spiders, which were predacious on the moths and their larvae, were also found.

HINTON (H. E.) & CORBET (A. S.). **Common Insect Pests of Stored Food Products. A Guide to their Identification.**—*Econ. Ser. Brit. Mus. (Nat. Hist.)* no. 15; [4+] 44 pp., 87 figs., 2 refs. London, 1943. Price 1s.

This booklet has been written to assist entomologists and others to identify the species of insects found in association with stored food products in Great Britain. The nine orders dealt with are the Thysanura, Orthoptera, Psocoptera, Rhynchota, Coleoptera, Lepidoptera, Hymenoptera, Diptera and Siphonaptera. There are brief general accounts of each Order or family, with notes on their habits, and keys based on characters that can be seen with the aid of a hand lens ($\times 15$) to the Coleoptera, Lepidoptera and cockroaches; figures illustrating structural characters that are used in the keys but are not easily defined in words are included. Some Orders, such as the Psocoptera and Hymenoptera, and the species of certain genera of beetles, particularly *Bruchus*, *Cryptophagus*

and *Laemophloeus* are not dealt with in detail, as the identification of the species can be undertaken only by specialists. A brief section on Arachnids is appended.

[GILYAROV (M. S.).] Гиляров (М. С.). **Parallelism in the Formation of the Entomocoenoses of Cereal Fields in Eastern Europe and northern America.** [In Russian.]—*Dokl. Akad. Nauk. SSSR* 38 no. 1 pp. 49–51, 9 refs. Moscow, 1943.

Since similar climatic zones occur in North America and European Russia, a brief survey is made of the phytophagous insects found in these areas in fields of cereals cultivated under approximately similar conditions of weather and soil. It is concluded that most of the individual species that attack cereals in eastern Europe are represented by analogous species in North America, and that in the main the complexes of insects that attack cereals, particularly wheat, on both continents comprise elements that are ecologically and biologically similar and causes similar types of injury. The evolution of similar secondary biocoenoses in the two regions after the occupation of large expanses of land with cereals suggests that the natural primary biocoenoses were similar, and that similar changes in environment produce parallel or convergent changes in entire biocoenoses as well as in individual organisms.

[GILYAROV (M. S.).] Гиляров (М. С.). **The Influence of Soil Conditions on the Soil Vermin Fauna.** [In Russian.]—*Pedology* 1939 no. 9 pp. 121–137, 3 maps, 57 refs. Moscow, 1939. (With a Summary in English.) [Recd. 1943.] **The Number of the Soil Fauna of dark coloured and Podzol Soils.** [In Russian.]—*Op. cit.* 1942 no. 9–10 pp. 3–15, 30 refs. 1942. (With a Summary in English.)

The first of these papers is a discussion, based on the literature, of the ways in which the type of soil influences the abundance and composition of the injurious insect fauna in it, namely the polyphagous larvae of Lamellicorns, Elaterids, Cistelids (Alleculids) and Tenebrionids. Separate sections deal with the effects of such properties of the soil as humidity, structure, acidity, salinity, humus content and degree of cultivation. A survey is also made of the distribution in European Russia of the more important agricultural pests in different soil zones, from which it is concluded that each type of soil is characterised not only by the vegetation, but also by a particular complex of injurious insects.

In the second paper it is shown that the soil fauna, including insects and mites and both saprophagous and phytophagous forms, is more numerous and occurs to a greater depth in a soil that is rich in humus than in one that is poor. It is less numerous in cultivated than in uncultivated soil of the same type.

Les *Antestia* spp. au Kivu.—*Publ. Inst. Etude agron. Congo belge Sér. sci.* no. 26, 69 pp., frontis., 9 figs., 5 graphs, refs. Yangambi, 1942.

This publication comprises seven papers on the Pentatomids of the genus *Antestia* that infest coffee in the Kivu region of the Belgian Congo. They include Leroy (J. V.) & Hendrickx (F. L.). Contribution à l'étude des dégâts causés par les *Antestia* aux caféiers (*Coffea arabica* L.) (pp. 3–9), and Lefèvre (P. C.). Etude économique des pyrèthrages (pp. 66–69), which have already been noticed [*R.A.E.*, A 30 282; 31 324]. The following are summaries of the others.

Hendrickx (F. L.). *Colletotrichum* ou *Antestia*? (pp. 10–16). The examination in 1938–39 of thousands of coffee berries showed that damage by the fungus, *Colletotrichum coffeanum*, and that by *Antestia* are often confused. The

author describes both types of injury and concludes that though infestation by the fungus destroys green berries or those in which the endosperm has not yet hardened, it cannot cause injury to the seeds in fruits in which they have formed, as *Antestia* does.

HENDRICKX (F. L.). Un nouveau dégât des *Antestia*: la castration des boutons floraux du caféier (*Coffea arabica* L.) (pp. 17-22). Observations have shown that damage to the floral buds by *Antestia* renders the anthers incapable of producing pollen and also prevents the stigma from receiving any, as the petals do not open to expose it. When coffee berries are not available the bugs choose parts rich in sap, and the floral buds, being tender and juicy, are specially attractive. The injury is identical with that recorded for the Capsid, *Lygus coffeae*, China (*simonyi*, auct.) in Kenya [20 337].

Lefèvre (P. C.) & Hendrickx (F. L.). Observations récentes sur les *Antestia* (pp. 23-33). In investigations in Kivu to ascertain the plants that may have been attacked by *Antestia* before coffee was introduced, nymphs from eggs collected on coffee were caged with fruits of *Galiniera coffeoides* and *Jasminum abyssinicum*, on both of which the bugs had been observed by the authors, and with fruits of *Trema guineensis* and *Bridelia micrantha*, two plants on which they were stated by the natives to occur. The bugs caged with fruits of *Trema* and *Bridelia* died before the fourth moult, but the others gave rise to adults that paired and oviposited. All the stages were shorter on fruits of *Galiniera* than on coffee berries and development from oviposition to adult emergence averaged 75 days. At Mulungu, at about 5,400 ft. altitude, the life-cycle on coffee berries in August-November averaged about 86 days in the laboratory. The durations of the various stages are compared with those recorded in other parts of Africa [7 406; 12 264; 26 178]. When disturbed by operations such as dusting, some of the bugs sometimes leave the coffee bushes and shelter on the shade trees. In investigations on the suitability of these for their survival, bugs were caged with leaves of six leguminous trees commonly used in Kivu. The most favourable were *Sesbania* sp., *Crotalaria agatifolia*, *Leucaena glauca* and *Tephrosia vogeli*, on which they survived for up to 25, 25, 26 and 28 days, respectively. Unfed bugs were all dead in a week. The bugs are unable to complete their life-cycle on coffee leaves, so that they are sometimes more abundant on dusted bushes bearing berries than on unproductive coffee bushes that have not been dusted.

Investigations on the necrosis caused by *Antestia* in the stalk of the coffee berry [30 283] showed that it occurs when the berries are young and have an average length of 1.07 cm., but not when they are older and have an average length of 1.59 cm. No necrosis was caused in a test with the Capsid, *Volumnus obscurus*, Popp. In further work, ripe berries that sank when placed in water were enclosed in batches of 10 with 10 examples of *Antestia*. About 9 per cent. floated after 24 hours, and about 15, 22, 28 and 49 per cent. of the remainder after 48, 72, 96 and 120 hours, respectively. In another experiment, 86 berries that sank initially all floated after being enclosed with 86 bugs for 8 days. The preferred food of *Antestia* being berries of which the endosperm is still soft, it was sought to ascertain whether the saliva of the bugs can dissolve polymerised substances. From the tests described, the authors conclude that the saliva contains amylase and so can dissolve some of the amylaceous compounds in the tissues that are punctured. The punctures made by the bugs are not very visible on the surface of the coffee berries, but after exposure for 24 hours to the vapour of formaldehyde they became clearly visible as black spots.

At Mulungu, the eggs of *Antestia* are parasitised by *Anastatus antestiae*, Ferrière, *Hadronotus antestiae*, Dodd, and *Acroclisoides africanus*, Ferrière, and nymphs in the late instars by *Mesochorus* sp. Infection by a fungus, probably *Verticillium* sp., destroyed bugs used for breeding in 1939.

Lefèvre (P. C.). Etude, dans son milieu, de *Antestia* prox. *lineaticollis* Stål (pp. 34–54). Unidentified species of *Leptocoris* (*Serinetha*), *Nezara* and *Aspavia* taken in small numbers on coffee in Kivu were found to cause necrosis of the stalk of the berries and injury to the flowers in the same way as *Antestia*. The Capsids, *Volumnus obscurus*, *Lygus coffeae* and *L. ghesquierei*, Schout., were found on coffee only during the pre-blossom period. Nymphs of *Antestia* deprived of food from hatching lived for not more than 9 days and failed to reach the second instar. When enclosed with leaves and flower stalks of 18 weeds and 9 leguminous plants used for cover, shade and hedges, all the nymphs survived for longer than 9 days but none completed the fourth instar. The results are shown in detail in tables. The maximum period of survival was 41 days on *Galinsoga parviflora*. It is assumed therefore, that, on hatching from eggs laid on unsuitable plants, the nymphs migrate, many of them eventually passing to coffee. In order to kill the maximum numbers of bugs on the coffee, it is advisable to increase the period between successive applications of pyrethrum dust in order to allow eggs to hatch. The interval should not exceed 21 days, however, which is the duration of the fifth instar, and one of 19–20 days is recommended. Coffee should not be dusted until it has been pruned and weeds mown or cleared away.

Lefèvre (P. C.). L'insecticide le plus employé au Kivu: la poudre de pyrèthre (pp. 55–65). *Chrysanthemum cinerariaefolium* is grown in Kivu, and a mixture of the powdered dried flowers and wood ash is commonly used against *Antestia* on coffee. An account is given of laboratory tests in which the effectiveness of the dusts was judged by the periods of contact required for 90 per cent. mortality of batches of equal numbers of nymphs and adults. The periods for a mixture containing 0.255 per cent. pyrethrins and 5.77 per cent. moisture increased from 17 to 56 hours as the period for which the dust had been mixed increased from 2 to 30 weeks; and those for mixtures prepared six weeks before and containing 0.255 per cent. pyrethrins increased from 21 to 58 hours as their moisture contents were increased from 5.77 to 12.77 per cent. Periods of 54, 58 and 60 hours, respectively, were required by dusts containing 1.15 per cent. pyrethrins that were stored for 6 months in a closed and an open container and a pyrethrum powder from Kenya (1.3 per cent. pyrethrins) that had been stored in a sack for 2 years. It is recommended that the dust should be made with freshly ground flowers, mixed as dry as possible, and used soon after mixing. The period of contact required was shorter for a dust containing 0.255 per cent. pyrethrins and 5.77 per cent. moisture that had been mixed two weeks previously than for a derris dust containing 5.3 per cent. rotenone and much shorter than for a dust prepared from the leaves of *Tephrosia vogeli*. For use against *Antestia*, pyrethrum powder containing 1.3 per cent. pyrethrins should be mixed in the proportion of 1:6 with wood ash; the method of preparing the dust is described and the most favourable conditions and technique of application are discussed.

VOLKONSKY (M.). Observations sur le comportement du criquet pèlerin (*Schistocerca gregaria* Forsk.) dans le Sahara algéro-nigérien.—*Arch. Inst. Pasteur Algérie* 20 no. 3 pp. 236–248, 1 fig., 1 map. Algiers, 1942.

This paper comprises a summary of the author's observations on *Schistocerca gregaria*, Forsk., in the extensive area of the Sahara that includes the Southern Territories of Algeria and Tunisia, the north-east of the French Sudan and the north-west of the Colony of the Niger. The selection of habitats by the newly hatched hoppers of the solitary phase appears to be influenced mainly by the water content of the different plant species, but during the coldest months (December–February) and the hottest months (May–September), the differences in temperature between habitats also appear to be of importance.

In winter, the hoppers live mainly on low plants, thus getting the benefit of the heat reflected by the soil and shelter from the wind. In hot weather, they concentrate on plants, such as *Schouwia* and *Hyoscyamus falezlez*, on which the temperature is lowered by strong evaporation, or climb shrubs to avoid the neighbourhood of the hot soil surface. If conditions are such that a hopper is able to maintain its internal temperature within favourable limits, it completes its development on a single species of plant and, as a result, develops a positive chemotaxis for the odour of that plant. When released on the soil down wind from plants, a hopper would move towards a plant of the species on which it had been feeding, even if the plant was hidden in a trench. The odour of some plants, such as the crucifers, *Schouwia* and *Zilla*, are not distinguished from each other by hoppers.

Kennedy's conception of the different stages in the phase transformation from *solitaria* to *gregaria* [R.A.E., A 28 28-31] is accepted by the author, but the term "gregarisation" is restricted to the process of the formation of stable bands and the beginning of mass movements, whereas the term "pregregarisation" is proposed for the sum total of the modifications (such as increased mobility and pigment changes) that are already manifested during the stages of "concentration" and "aggregation." Observations on "pregregarisation" show that the first contacts occur between hoppers living on the same plant and seeking shelter from wind and a basking place on the same leaf; when feeding, hoppers may form groups due to chemotactic attraction to the plant tissue exposed by biting. The first basking and sheltering groups on the soil surface are formed later when hoppers acquire some mobility through mutual stimulation. During the further development of the hoppers, the seasonal vegetation tends to dry up, except *Schouwia*, which usually grows in the middle of a wadi, and it is there that hoppers concentrate. In the concentration zone, the older hoppers tend to wander individually and to exhibit an attraction to each other. For example, if a cage containing 200 hoppers (living or dead, or even dried) is placed in a zone where other hoppers are wandering, a procession is formed towards the cage in the lee of the wind current coming from it. On reaching the cage, the hoppers climb over it and disperse in different directions, mainly towards the nearest plants. Some, however, turn back and move in the opposite direction, so that two parallel processions in opposite directions may be formed. When two or more hoppers move parallel to each other in the same direction, their movements are accelerated owing to mutual visual stimulation. If the cage containing hoppers is placed just in the lee of a tuft of plants, the wandering hoppers attracted by the cage enter the tuft, and some of them stop there, while others move away. Five-minute counts show that the numbers of hoppers entering and leaving the tuft are approximately equal, so that there appears to exist a "saturation density" of the population, which is only slightly higher than the density in the whole concentration zone and very much lower than in the case of the gregarious hoppers.

True gregarisation was observed in 1939 [28 325; 31 424], when adults of the second spring generation, exhibiting characters approaching phase *gregaria*, oviposited in very restricted areas, and most of the resulting hoppers were gregarious in their behaviour and coloration. They were in unstable groups, continually forming and re-forming.

Observations on bands of the pure phase *gregaria* show that their wanderings, in the absence of insolation, occur when the body temperature is above 25-27°C. [77-80.6°F.]. The upper limit is above 40°C. [104°F.], and the temperature range of activity increases with the size of the band, as well as with reduction in the density of vegetation. The cohesion of bands of phase *gregaria* is mainly due to the visual mutual attraction of the hoppers, and olfactory attraction plays only a secondary part, acting when visual stimuli are excluded. Although the direction of young hopper bands is apparently indefinite, they exhibit tendencies to follow the line of least resistance; to move up or down a distinct

slope ; beginning with the third stage, to move down the beds of dry water-courses ; and to move towards tall vegetation, owing to visual attraction.

The behaviour of the recently emerged adults is, on the whole, very similar to that of the older hoppers ; olfactory mutual attraction is more important, though it does not result in a concentration and the dispersal of young adults of phase *gregaria* is accompanied by a loss of olfactory attraction. The behaviour of adults during the reproductive period is practically the same for phases *gregaria* and *solitaria*. Sexual maturation is accompanied by stronger attraction to succulent vegetation. Oviposition is restricted to light humid soils, and the meeting of the sexes is facilitated by their independent attraction to suitable places.

The conclusions reached by Ramchandra Rao with regard to seasonal migrations of *S. gregaria* in India [31 156] appear to hold good for the Sahara, although only indirect evidence is available. The majority of the solitary individuals appear to migrate between the central Sahara, where they stay in winter and spring and are able to reproduce only in certain seasons with favourable rainfall, and the southern edge of the Sahara, where they go in summer and where regular breeding is always possible. The northern Sahara, where breeding would be possible after spring rains, is normally not reached by solitary individuals, but swarms of phase *gregaria* have a wider range of migration and breed in this northern zone. During migrations of solitaries, flights usually begin at dusk, and the tendency to sustained flight is favoured by preliminary loss of water by the locust. The orientation of sustained flight depends on geographical and, apparently, also on seasonal factors ; in the Algiers area, the direction is towards the south at all times of the year, but experiments made in winter and spring showed that this southerly orientation disappears in the northern Sahara and gives place to a northerly orientation in the central Sahara, though in May a certain proportion of flights in the central Sahara were towards the south. One of the main factors in migrations of solitaries is the regional desiccation of the seasonal vegetation, but the direction of migration is not determined directly by the humidity gradient, which may only influence the local movements of locusts. A few of the solitaries do not migrate but survive the unfavourable season in specially favoured localities.

HARRIS (W. V.). **Maize Storage.**—*E. Afr. agric. J.* **8** no. 4 pp. 190-196, 4 figs. Nairobi, 1943.

An account is given of methods of storing maize in East Africa designed to prevent damage by rats or insects and excessive moisture, which are the three main, and interacting, causes of deterioration. Figures are cited of the moisture contents of well dried maize exposed to the air in Southern Rhodesia, different parts of Tanganyika and the relatively damp Kenya highlands. The two primary insect pests in these areas are *Calandra oryzae*, L., and *Sitotroga cerealella*, Ol. ; *Tenebroides mauritanicus*, L., *Laemophloeus minutus*, Ol., *Tribolium confusum*, Duv., *T. castaneum*, Hbst., and *Rhizopertha dominica*, F., feed only on damaged grain, and their numbers indicate the degree to which infestation by the primary pests has progressed. Adults of *C. oryzae* live more than four months, during which time the females may lay 300-400 eggs in small holes bored in the grains. The larvae feed and pupate in the grains. The rate of development and the activity of the females depend on air temperature and the moisture content of the grain, and are greatest at 82°F. Activity is slight between 45 and 70°, and only 52 per cent. of 250 adults kept at a temperature just below freezing point survived for two days and 2 per cent. for five days. All stages are killed in a few minutes at 125°. The weevil cannot live on grain with a moisture content as low as 8 per cent., activity is slight up to 10 per cent. and then increases rapidly to a maximum at 17 per cent.

The moisture content of the maize should therefore be kept below 9 per cent. if possible, or else the grain should be stored either at temperatures well below 70°F. or out of reach of weevils.

The eggs of *S. cerealella* are laid on the surface of the grain, and the larvae bore into it and feed for about three weeks before pupating. The female usually deposits 40–100 eggs, and the life-cycle lasts five weeks. Most damage is done to maize on the cob, particularly when it is stored after husking. Only the top 6–9 ins. of shelled grain is infested, as the larvae cannot penetrate further. Damage may be avoided by drying the cobs rapidly, shelling early and storing the grains in bags or covered bins. Grain that is to be kept on the cob should be well covered with the husk.

HUNT (G. M.). & SNYDER (T. E.). **An international Termite Exposure Test.—Twelfth Progress Report.**—[*Proc.*] *Amer. Wood Pres. Ass.* [37] preprint 13 pp. [Baltimore, Md.] 1941. **Thirteenth Progress Report.**—*Op. cit.* [38] preprint 13 pp. 1942.

In these two annual reports on the progress of a large-scale experiment on the effectiveness of various chemicals in preserving specimens of wood from attack by decay and termites [*cf.* *R.A.E.*, A 28 580], data are given in tables on the condition of the original specimens in Australia, the Panama Canal Zone, Hawaii and South Africa after 12 and 13 years' exposure and of subsequent series of specimens installed in the Canal Zone in 1931, 1933 and 1938 [*cf. loc. cit.*]. It is still considered that the tests must be continued for many years before the results can safely be applied for the selection of preservatives to use on a commercial scale.

PEMBERTON (C. E.). **Entomology.**—*Rep. Comm. Exp. Sta. Hawaii. Sug. Pl. Ass.* 1941–42 pp. 18–22. Honolulu, 1943.

Insect pests of sugar-cane caused little serious damage in Hawaii during the year ending 30th September 1942. *Anomala orientalis*, Waterh., was of no importance, and its parasites, *Campsomeris marginella modesta*, F. Sm., and *Tiphia segregata*, Crwf., continued to be abundant in the infested areas.

Pyrophorus bellamyi, Zwaluwenburg, the predacious Elaterid introduced against it from Guatemala, has not been recovered in Hawaii since its release there in 1935–36 [*R.A.E.*, A 26 493, etc.], but investigations by E. A. Bianchi in 1941 indicated that *P. radians*, Champ., was more abundant in Guatemala and so might have a better chance of establishment. He therefore shipped larvae of the latter to Hawaii in December, and adults obtained from some of them were liberated in May 1942. If established, this predator is likely also to be of value against *Adoretus sinicus*, Burm. *Rhabdoscelus* (*Rhabdocnemis*) *obscurus*, Boisd., continued to decrease owing to changes in the varieties of sugar-cane grown and to the parasite, *Ceromasia* (*Microceromasia*) *sphenophori*, Villen., but some instances of injury occurred, chiefly in varieties in which a considerable number of the stalks are dead or dying at harvest.

In view of the severity of damage by the common armyworm, *Laphygma exempta*, Wlk., in the previous year [30 496], when chemical control was ineffective and biological control was hindered by chemicals used to destroy weeds, a search for other parasites for liberation in areas where weed control is not practised was begun by Bianchi in Texas in April 1942. Consignments of five parasites of *L. frugiperda*, S. & A., were sent to Hawaii, and 1,103 living adults were obtained, of which 895 were released and the rest retained for breeding. The species concerned were *Chelonus texanus*, Cress., *Meteorus laphygmae*, Vier., *Rhogas laphygmae*, Vier., *Neopristomerus appalachianus*, Vier.,

and *Apanteles marginiventris*, Cress., and all except the last were released in good numbers. *M. laphygmae* appears to be the most promising. The scarcity of *L. exempta* in the field during the year complicated the establishment of the parasites, but some that were liberated among tomatoes and maize on which larvae of *Heliothis armigera*, Hb., were abundant attacked this species and may survive on it until further outbreaks of *L. exempta* occur. Some of the parasites were successfully reared on native armyworms in the laboratory.

Timber impregnated with copper naphthenate and buried in the soil and untreated timber buried in soil treated with a proprietary oily liquid known as Standard Oil Termite Compound remained undamaged by *Coptotermes formosanus*, Shir., after a period of 13 months, when untreated timber and timber in untreated soil was completely destroyed. Buried timber was also protected from termite attack by treating the soil with a strong solution of sodium arsenite.

Insect Pests.—*Agric. Gaz. N.S.W.* 54 pt. 4 pp. 159–162, 5 figs., 1 ref. Sydney, 1943.

This part of a series [*cf. R.A.E.*, A 31 263] comprises notes on insects that sometimes occur in sufficient numbers to cause serious damage to sweet potato in New South Wales. They include the Sphingids, *Herse convolvuli*, L., *Hippotion celerio*, L., *H. scrofa*, Boisd., and *Theretra oldenlandiae*, F., the larvae of which feed on the leaves and can be controlled with a spray of 2 oz. lead arsenate in 4 gals. water or a dust of 10 per cent. lead arsenate in kaolin; *Cylas formicarius*, F. [*cf. loc. cit.*], the adults of which are controlled with the same spray or a dust of double strength, when feeding on leaves and stems; cutworms, against which a bait of 1 lb. Paris green or 9 oz. white arsenic or sodium arsenite, 24 lb. bran, 8 oz. salt and 2½ gals. water should be broadcast at the rate of 50 lb. per acre several days after clearing the ground for planting, and throughout the infested areas if the plants are attacked later; and flea-beetles, which are controlled by the treatments recommended against *C. formicarius*. *Tetranychus telarius*, L. (*urticae*, Koch) sometimes causes serious injury to the leaves during dry weather; it can be destroyed by dusting with a mixture of fine sulphur and hydrated lime (2 : 1) or spraying with lime-sulphur (1 : 100).

Cawthron Institute, Nelson, New Zealand. Annual Report 1941.—34 pp. Nelson, N.Z. [1942].

Accounts of entomological investigations in New Zealand are given in two consecutive sections of this report (pp. 27–31). Work on the biological control of noxious plants [*cf. R.A.E.*, A 30 278] included the release of over 10,000 adults of the gorse seed weevil [*Apion ulicis*, Forst.] against gorse [*Ulex europaeus*] in areas where liberations had not previously been made; more than 121,000 have now been released, and the weevil is increasing and spreading from each point of liberation. Gorse in one area was killed by the cottony cushion scale [*Icerya purchasi*, Mask.], but it is not likely to be of permanent effectiveness since it was being attacked by *Rodolia (Novius) cardinalis*, Muls., and the parasite, *Cryptochetum iceryae*, Will. *Hylemyia (Pegohylemyia) jacobaeae*, Hardy, showed no marked increase on ragwort [*Senecio jacobaea*] in experimental plots, but infested flower heads were more widespread than in former years on a farm where it had previously been liberated. The cinnabar moth [*Tyria jacobaeae*, L.] was found in considerable numbers on ragwort in five districts. Several thousand larvae of *Antholcus varinervis*, Spin., were found on piripiri [*Acaena*] near Nelson [*cf. loc. cit.*] over an area of approximately 200 sq. yds., and in several places the plants were practically defoliated.

Of the parasites liberated against *Pieris rapae*, L., *Pteromalus puparum*, L., continued to exert major control and *Apanteles glomeratus*, L., reared from material introduced from the United States [8 28], was found to be established in one district. A Tachinid of the genus *Compsilura* that was recently imported from Canada, where it parasitises *P. rapae* and many other hosts, readily attacked larvae of *P. rapae* in the laboratory. Promising results against *Plutella maculipennis*, Curt., were given by *Angitia cerophaga*, Grav., and *Thyraeella* (*Diadromus*) *collaris*, Grav. [cf. 29 333]; field surveys in the Waimea plains, Nelson, showed that the former destroyed 20 per cent. of the larvae and the latter 61 per cent. of the pupae. Serious damage to cocksfoot grass [*Dactylis glomerata*] was caused by an unidentified Lepidopterous larva that bored in the stems.

PAPERS NOTICED BY TITLE ONLY.

TREHAN (K. N.). **The Rôle of Predators in Biological Control of Insect Pests** [a review of the literature].—*Curr. Sci.* 12 no. 8 pp. 223–225, 16 refs. Bangalore, 1943.

BITANCOURT (A. A.). **Expressão matematica do crescimento de formigueiros de *Atta sexdens rubropilosa* representado pelo aumento do numero de olheiros.** [The mathematical Expression of the Growth of a Nest of *A. sexdens rubropilosa*, Forel, as shown by the Increase of the Number of Openings].—*Arq. Inst. biol.* 12 pp. 229–236, 2 graphs, 2 refs. São Paulo, 1941. (With a Summary in English.) [Recd. 1943.]

NOTICES.

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